

dbx Model 122/124

tape noise reduction systems

INSTRUCTION MANUAL



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WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

FUNCTIONAL CALLOUTS

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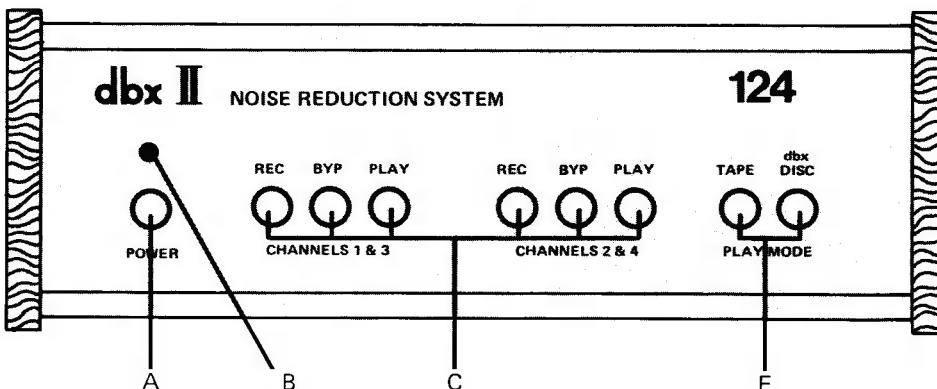
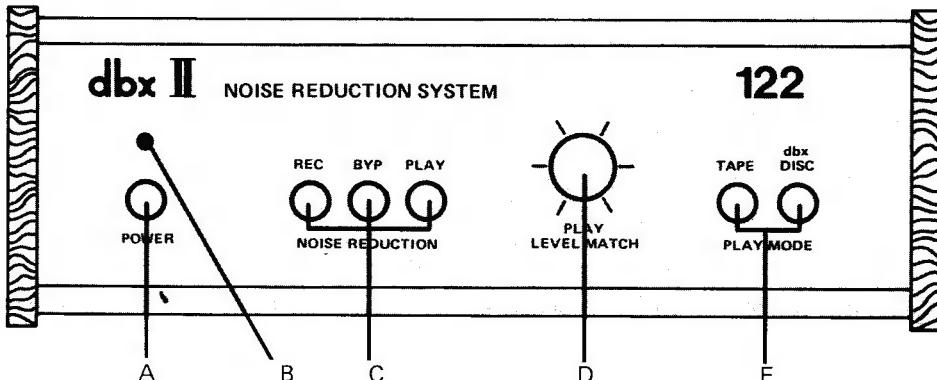


Fig. 1 — Model 122 and Model 124 Front Panels (Descriptions on next page)

NOTES: To avoid repetition, the word "preamplifier" is used to mean preamplifier, integrated amplifier/preamplifier, receiver, or the tape monitor loop of an equalizer, reverb unit or other device.

If your preamplifier does not have a tape monitor loop* (tape record outputs and play inputs), substitute other suitable connections.

A. Power Switch

Push once to turn ON the dbx unit's AC power, push again to turn it off.

B. Pilot Lamp

When the Pilot Lamp is illuminated, the AC power is ON.

C. Noise Reduction Switches

REC Push this switch and the TAPE switch to record a dbx-encoded tape.

BYP Push this switch to bypass the dbx noise reduction circuitry (a "hard-wire" bypass).

PLAY Push this switch and the TAPE switch to play back a dbx-encoded tape. Push this switch and the DISC switch to play back a dbx-encoded disc.

NOTE: For a stereo setup using the 124, leave channels 1 & 3 switched to REC and channels 2 & 4 switched to PLAY. For the 122 in a stereo setup or the 124 in a 4-channel setup, it will be necessary to switch all channels between the REC and PLAY modes.

D. Play Level Match

This control allows you to adjust the 122's output level to your preamplifier. Like the RECORD LEVEL MATCH control, this adjustment is not critical and does not affect the linearity of the dbx encode/decode process. PLAY LEVEL MATCH is adjusted so that playback levels are approximately the same when you are decoding a dbx encoded tape or disc as when you have the 122 in BYPASS mode for playing a conventional source. Detailed instructions for this adjustment are on Page 15.

E. Play Mode Switches

TAPE Push this switch and the appropriate Noise Reduction Switch (REC or PLAY) to record or playback a dbx-encoded tape.

DISC Push this switch and the PLAY switch to play a dbx-encoded disc. If the 124 is set up for two channel simultaneous record and playback, as shown in Figure 5, press the BYP switch on Channels 1 & 3, the PLAY switch on Channels 2 & 4, and the DISC switch. To play a conventional (non-encoded) disc through the dbx unit, push the BYP switch and the DISC switch; alternately, switch the dbx unit out of the circuit by placing the preamp in SOURCE mode.

*The tape or record outputs and tape or play inputs located on the rear of most preamplifiers, integrated amplifiers and receivers for operation of a tape recorder.

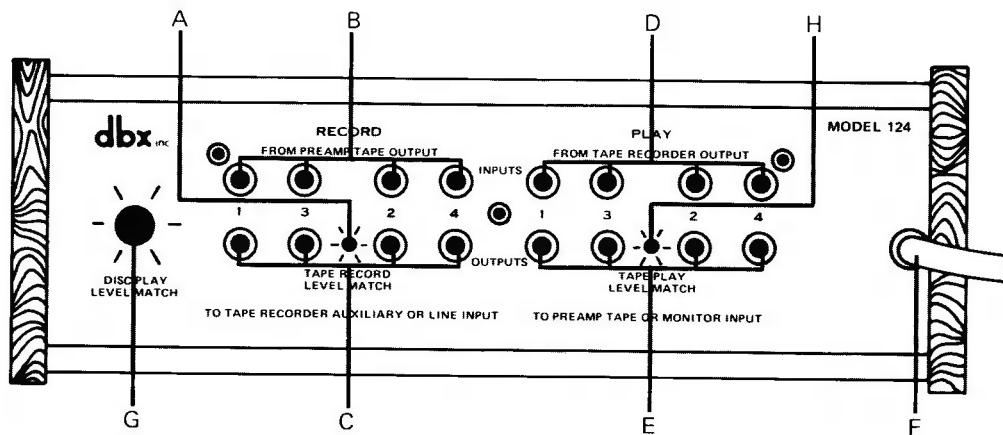
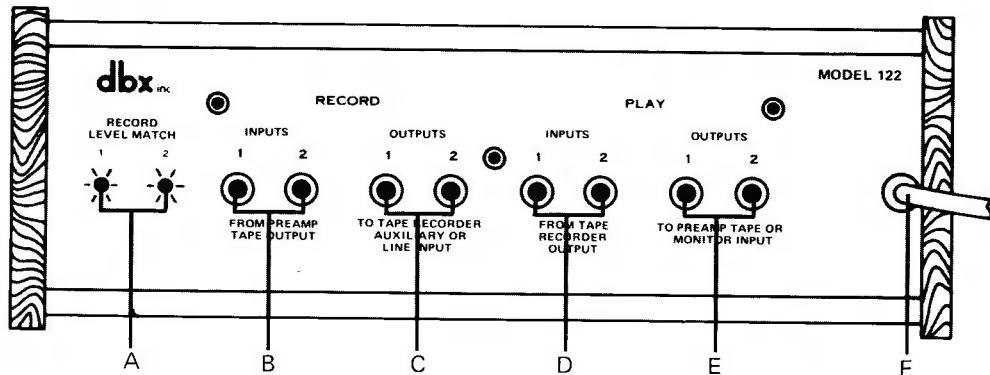


Fig. 2 — Model 122 and Model 124 Rear Panels (Descriptions on next page)

A. (Tape) Record Level Match Control

This control allows you to match the dbx Record Output level to your tape recorder's input sensitivity. Setting is non-critical, and in most cases a center-range setting of about 12 o'clock will suffice; for more exact settings, use a test record or tone generator as described on Page 15. In no case will the LEVEL MATCH setting affect the dbx unit's encode/decode performance. (NOTE: The 122 has 1 control per channel. The 124 has 1 control to simultaneously adjust 4 channels.)

B. Record Inputs

Connect the cables from your preamplifier's TAPE OUTPUTS (REC OUT of the Tape Monitor Loop) to these inputs. These cables were previously connected to your tape recorder's LINE or AUX (Record) INPUTS. (Use only the #1 and #3 RECORD INPUTS for the 124 in a stereo sound system.)

C. Record Outputs

Connect the cables from these outputs to your tape recorder's LINE or AUX (Record) INPUTS. (Use only the #1 and #3 RECORD OUTPUTS for the 124 in a stereo sound system.)

D. Play Inputs

Connect the cables from your tape recorder's LINE or AUX (Play) OUTPUTS to these inputs. (Use only the #2 and #4 PLAY INPUTS for the 124 in a stereo sound system.)

E. Play Outputs

Connect the cables from these outputs to your preamplifier's TAPE INPUTS (Play Inputs of the tape monitor loop). These cables previously came from your tape recorder's LINE or AUX (Play) OUTPUTS. (Use only the #2 and #4 PLAY OUTPUTS for the 124 in a stereo sound system.)

F. AC Power Cable

Connect this cable to 117V, 50 or 60Hz AC power source only. The Model 122 requires a maximum of 5W of AC power while the Model 124 requires a maximum of 7W of AC power.

G. Disc Play Level Match Control

This control allows you to adjust the 124's output level to your preamplifier when you are playing a dbx-encoded phonograph disc. This adjustment is not critical and does not affect the linearity of the disc decoding process. Adjust the DISC PLAY LEVEL MATCH control so that playback levels are approximately the same whether you are decoding a dbx disc or have the 124 in BYPASS mode for a conventional source.

H. Tape Play Level Match Control

This control allows you to adjust the 124's output level to the tape play input of your preamplifier. Like the RECORD LEVEL MATCH control, this adjustment is not critical and does not affect the linearity of the encode/decode process. Adjust the TAPE PLAY LEVEL MATCH control so that playback levels are approximately the same whether you are decoding dbx encoded tapes or have the 124 in BYPASS mode for a conventional source. Detailed instructions for this adjustment begin on Page 15.

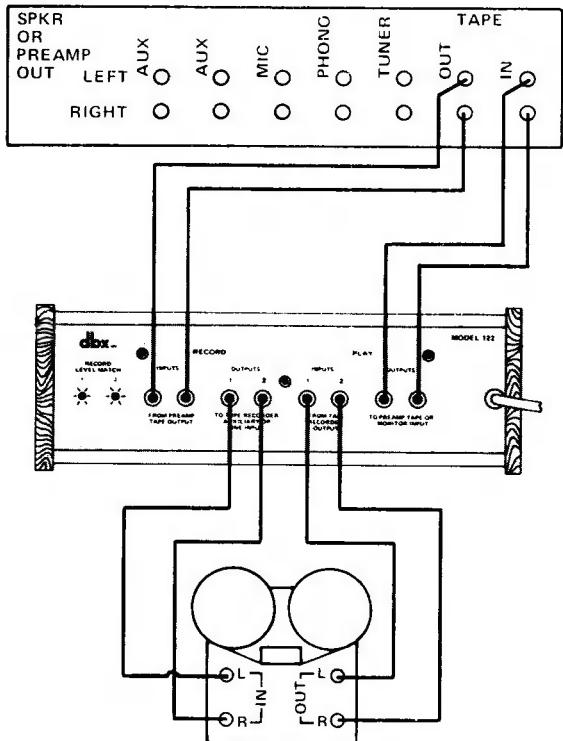


Fig. 3 – Connecting the dbx 122 in a Tape Monitor Loop

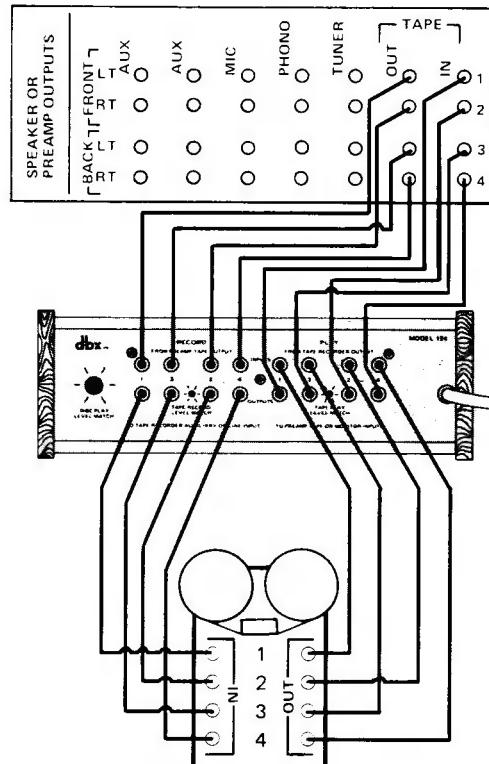


Fig. 4 – Connecting the dbx 124 in a Tape Monitor Loop for Four-Channel Operation

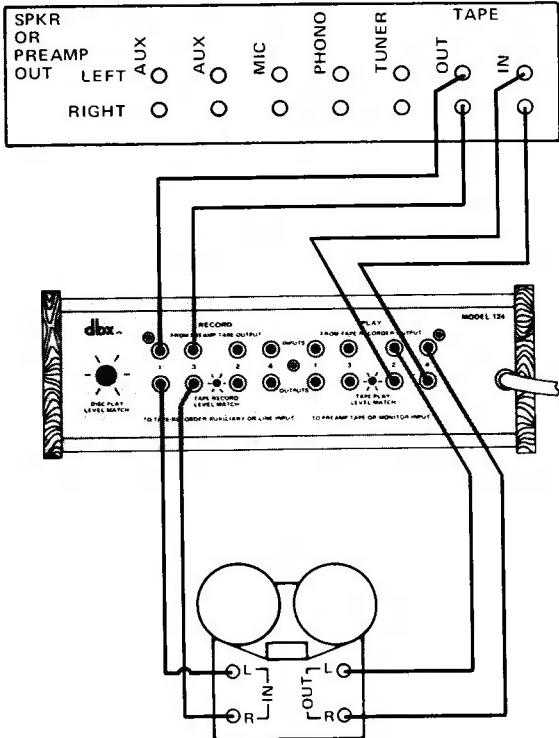


Fig. 5 – Connecting the dbx 124 in a Tape Monitor Loop for Two-Channel Simultaneous Operation

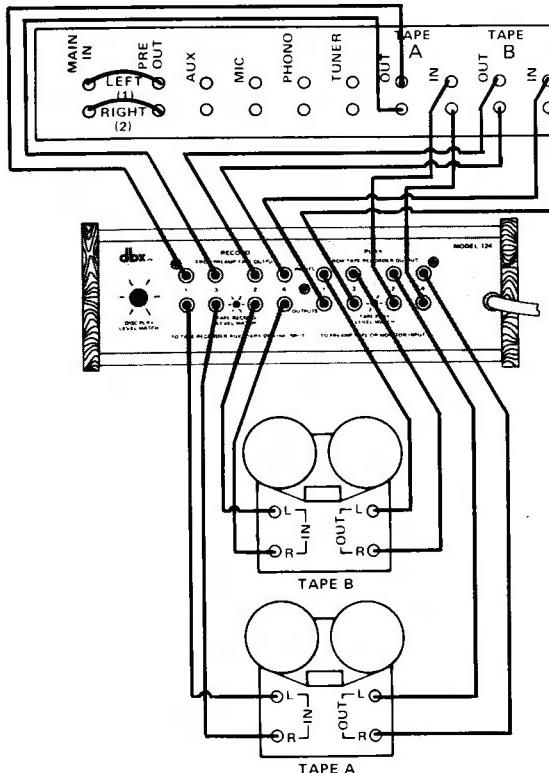


Fig. 6 – Connection of the 124 with Two Tape Machines and a Preamplifier having Two Tape Monitor Loops

To simultaneously record and monitor on machine "A," set the 124's channel 1 & 3 switches to REC and channel 2 & 4 switches to PLAY mode. To simultaneously record and monitor on machine "B," set the 124's channel 2 & 4 switches to REC and channel 1 & 3 switches to PLAY mode.

NOTE: This setup cannot be used for disc decoding.

BRIEF OPERATING INSTRUCTIONS

To Make a dbx-Encoded Tape Recording

1. Set the preamplifier's INPUT SELECTOR to the appropriate source (i.e., PHONO, TUNER, or AUX).
2. Press the dbx REC switch(es) and the dbx TAPE switch.
3. Place the tape machine in Record mode, and adjust the tape machine for peak meter levels typically 3 to 6VU lower than normal. (With dbx processing, significantly lower record levels are often required to eliminate tape saturation, particularly in cassette recording. Experiment during initial setup to find the appropriate levels.)
4. Do not switch the dbx unit while making the recording.

To Play a dbx-Encoded Tape Recording

1. Set the preamplifier's TAPE MONITOR switch to TAPE.
2. Press the dbx PLAY switch(es) and the dbx TAPE switch.
3. Place the tape machine in Play mode, and adjust the preamplifier VOLUME and/or the PLAY LEVEL controls on the tape machine for the desired listening volume.

To Play a dbx-Encoded Phonograph Disc

1. Press the dbx PLAY switch(es) and the dbx DISC switch.
2. Set the preamplifier's INPUT SELECTOR to PHONO, and set the TAPE MONITOR switch to TAPE.
3. Play the encoded record, and adjust the preamplifier's VOLUME control for the desired listening volume.

INTRODUCTION

The tape recording process traditionally has been one of the major sources of noise in recorded music. The dbx tape noise reduction system eliminated tape hiss that would otherwise be introduced by the tape recorder. In addition, dbx processing permits recordings to be made at levels that avoid much of the distortion which normally occurs in tape recording. As a result, dbx equipment not only reduces noise, it can vastly improve tape machine performance. With dbx processing, the only noise heard on playback is that noise which was present in the original program. Taped records, upon playback, will sound just like the original disc; taped FM broadcasts, upon playback, will have no more noise than was present in the original reception of the program; and recordings of live music, conversation, and so forth, will be indistinguishable from the live event. These genuine improvements in the quality of tape recordings are due to a phenomenal increase in recordable dynamic range and the complete absence of audible tape-induced noise.

The dbx Model 122 has two processors for recording or playback of a stereo program. The dbx Model 124 has four processors, essentially two Model 122's in a single unit. The 124 is switchable for recording or playback of a four-channel program, or for simultaneous recording and off-tape monitoring of a stereo program. Both models share the same high standard of performance, in excess of 30dB broadband tape noise reduction with a simultaneous 10dB improvement in headroom in the tape recording process. Both models may also be used to decode special dbx encoded phonograph discs. These discs, available through many hi-fi stores, are up to 40dB quieter than a conventional disc and can provide full music dynamic range.

The dbx disc decoding circuits are not designed to reduce noise on conventional phonograph records. Neither can the

dbx tape noise reduction circuits reduce hiss on a tape which has already been recorded without dbx tape noise reduction during the recording process. However, dbx dynamic range enhancers such as our Models 3BX and 118 are capable of reducing noise on a conventional disc, pre-recorded tape or FM broadcast. These enhancers (expanders) can be used in conjunction with a dbx II tape noise reduction unit. In this combination the dbx 122 or 124 tape noise reduction unit prevents any additional noise from being introduced by the tape recording process and the dbx dynamic range enhancer actually increases the dynamics and reduces noise present in the original program.

The 122 and 124 are fully compatible with all other dbx II units, such as the 140 series or the Model 128. The Model 128 combines the functions of the 122 with a dbx dynamic range enhancer.

The 122 and 124 are not compatible with dbx Professional equipment, and vice-versa, even though all dbx tape noise reduction systems offer the same 30dB of tape noise reduction and 10dB headroom improvement. The incompatibility is due to signal processing differences, as described on Page 30 of this manual. Thus, recordings encoded with any of the dbx 150 semi-professional series or with the 177, 187, 208, 216, or K9-22 professional series will not sound "right" when played back through the 122 or 124. Also, while the 122 and 124 are made to decode dbx-encoded discs, dbx professional series equipment should not be used for disc decoding.

Alone, either the dbx 122 or 124 will dramatically improve the quality of your live tape recordings. In conjunction with any of the dbx dynamic range enhancers, the 122 or 124 lets you make recordings of pre-recorded material or radio broadcasts that can be played back with wider dynamic range and less noise than the original source.

When used properly, dbx tape noise reduction makes an extremely valuable addition to your music system and to your listening enjoyment. This manual describes how your dbx 122 or 124 functions, and how you can obtain maximum benefit from its use.

DETAILED OPERATING INSTRUCTIONS

GENERAL NOTES

Level and Impedance

The 122 and 124 input levels, output levels and impedances are designed for compatibility with most hi-fi and semi-pro equipment. Because the dbx 122 and 124 input impedance is 50k-ohms, the units can be driven from high or low impedance sources. The dbx inputs also will accept a wide range of voltages. The dbx outputs will drive up to 7 volts into loads of 5000-ohms or greater. This means that you can connect the 122 or 124 output to almost any type of equipment found in a normal hi-fi or semi-pro system. However, the dbx 122 and 124 are not meant for professional levels of +4dBm (1.23V) to +8dBm (1.95V), nor are they meant for driving low impedances, such as 600-ohm professional inputs. Use the dbx 150 semi-professional series or any of the dbx professional series units for these applications.

Grounding

The 122 and 124 are not grounded to the power mains through their power cords. They obtain a ground via the shields of the interconnecting audio cables from the pre-amplifier, receiver, and/or from the tape machine. No special ground wires need be connected between the dbx chassis and any other equipment. If you hear hum, try reversing the AC plug, and if that does not help, check to make sure all audio cables are properly installed and that there are not broken conductors in any cable. Hum and radio station pickup are sometimes caused by microscopic

dirt particles on the mating surfaces between the chassis and cable connectors, so clean these areas periodically.

Cable Length

Some installations will tolerate longer cables, but whenever possible it is a good idea to keep signal cable runs under 10 feet. This minimizes hum and noise pickup, and also helps prevent high frequency losses naturally caused by cable capacitance.

dbx and Dolby®* Together

The dbx II tape noise reduction system provides at least 20dB more noise reduction than Dolby "B" tape noise reduction systems, and 15dB more than Dolby "A," so there is no need to use Dolby processing. If your tape machine has internal Dolby processing, switch it Off and use only the dbx II encoding and decoding. Dolby encoded tapes are not compatible with dbx II decoding (and vice-versa); if a tape was recorded with Dolby encoding, it must be Dolby decoded.

NOTE: While it is possible to combine both dbx II and Dolby processing, we do not recommend it because any imperfections in the Dolby encode/decode processing will be magnified by dbx II treatment. Since dbx II processing alone reduces noise to inaudibility, there is really no need to use dbx II with another tape noise reduction system.

*"Dolby" is a trademark of Dolby® Laboratories Inc.

CONNECTIONS

Where to Connect Your dbx 122 or 124

If your preamp, receiver, or integrated amp/preamp has tape monitoring provisions, the dbx should be connected within the tape monitor loop. In other words, connect the TAPE OUT of your preamp to the dbx's RECORD INPUTS, and connect the dbx's PLAY OUTPUTS to your preamp's PLAY or TAPE INPUTS (Figures 3, 4 & 5).

For preamps, receivers or integrated amps that *do not have tape inputs and outputs*, connect the PREAMP OUTPUTS to the dbx's RECORD INPUTS, and connect the dbx's PLAY OUTPUTS to your preamp's AUX INPUTS (Figure 7). When recording an encoded tape with this setup, it is very important to keep all preamp filter and tone controls set at "flat," or whatever setting yields the flattest frequency response. Any desired tonal adjustments can be made later, during playback of the dbx-encoded tape.

CAUTION: With the setups shown in Figure 7, DO NOT switch your tape machine to "SOURCE" monitor mode while the preamp is set for "AUX IN" mode. This would cause feedback that might damage your equipment.

Where to Connect Your Tape Recorder

Connect the dbx's RECORD OUTPUTS to the RECORD INPUTS, or LINE INPUTS of your tape recorder. (Do not connect the dbx's RECORD OUTPUTS to the MIC INPUTS of your tape recorder because the dbx output level is too high for most mic inputs and could cause distortion.) Connect your recorder's PLAY OUTPUTS, MONITOR OUTPUTS, or LINE OUTPUTS to the dbx's PLAY INPUTS (Figures 3, 4 & 5).

When Using Two Tape Recorders

The 124 may be connected so that either of two tape recorders can be used with simultaneous recording and off-tape monitoring, with no re-connections (See Figure 6).

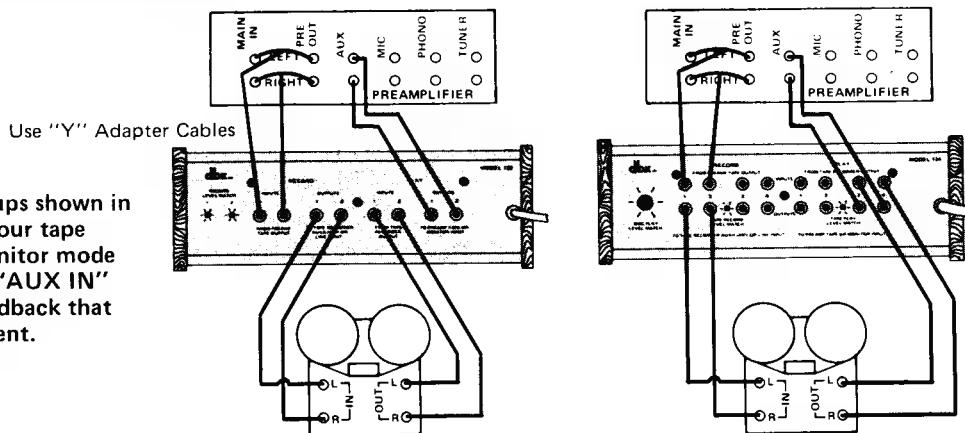


Fig. 7 – Connecting the dbx Unit When There Is No Tape Monitor Loop

Graphic Equalizers

If you use a graphic equalizer with your music system, the equalization *must not* be introduced between the dbx's RECORD OUTPUTS and the tape recorder's inputs, or between the recorder's outputs and the dbx's PLAY INPUTS. Ideally the dbx unit is installed in the preamp's tape monitor loop, and the graphic equalizer is installed between the preamp output and the power amplifier input (Figure 8). Alternately, install the graphic equalizer in the preamp's tape monitor loop and place the dbx unit in the graphic equalizer's tape monitor loop, but *be sure to set the equalizer so its effect comes after the dbx unit.*

Equalized Speaker Systems

If you have an equalized speaker, such as a Bose system or Electro-Voice "Interface" series, then the dbx unit can be connected in the speaker equalizer's tape monitor loop and the equalizer should be installed in the preamp's tape monitor loop (Figure 9).

NOTE: Never connect any other electronic equipment between the dbx unit and your tape recorder's inputs or outputs. This could cause inaccurate encode/decode tracking and loss of quality in the recorded signal.

CAUTION: Make sure that the power is OFF on all equipment when installing the dbx unit. As a precaution, turn down your amplifier VOLUME control prior to switching on the dbx unit for the first time. Inadvertent decoding of non-encoded programs (dbx in PLAY mode) can create surging to high volume levels.

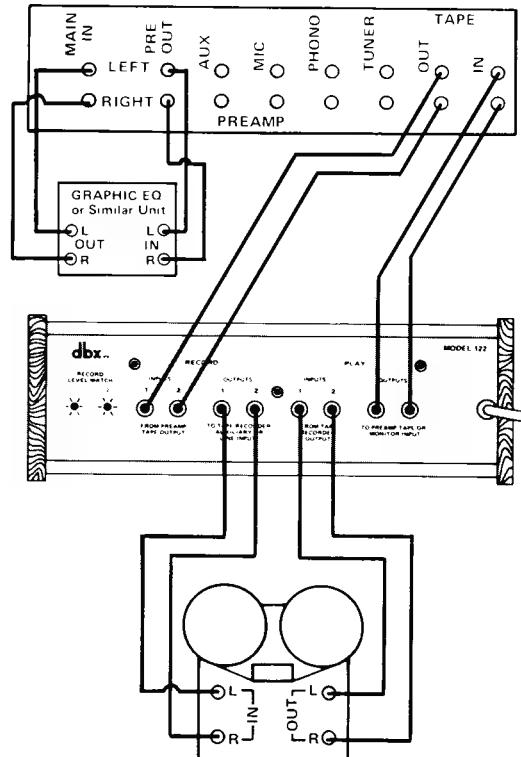


Fig. 8 — Where to Connect a Graphic Equalizer, Electronic Cross-over, Reverb, Matrix 4-Channel Decoder, Etc.

(Special signal processing follows the dbx encode/decode process.) Setup for dbx 124 on next page.

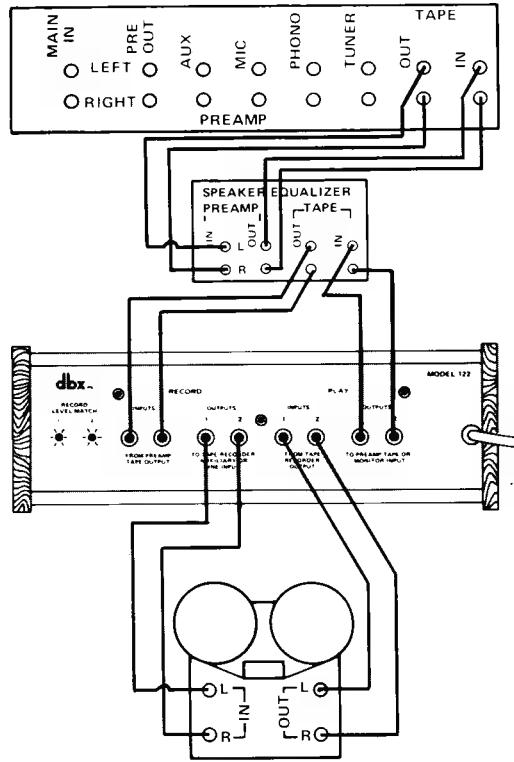
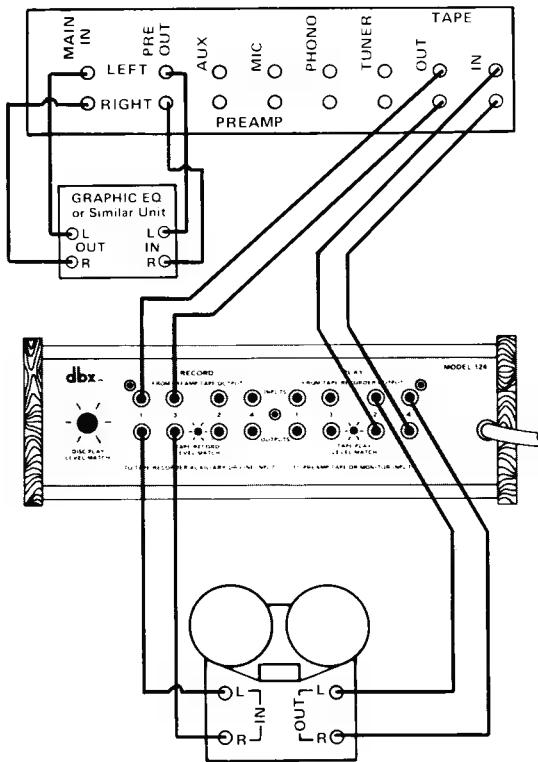
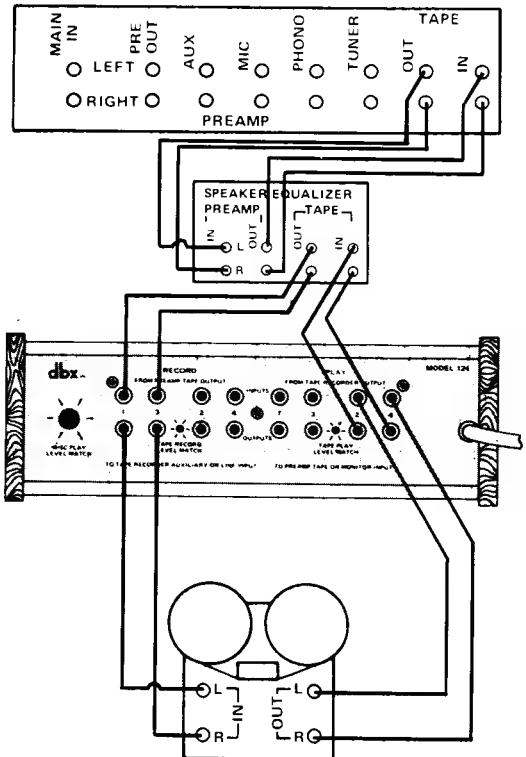


Fig. 9 – Connecting the dbx Unit with an Equalized Speaker System
 (dbx processing is done inside the tape monitor loop of the speaker equalizer, which itself is in the tape monitor loop of the preamplifier.) Setup for dbx 124 on next page.



Simultaneous Stereo Record and Playback (Off Tape Monitoring) Connections for the 124

If your tape recorder has provisions for simultaneous recording and playback (off tape monitoring), the 124 can be connected as shown in Figure 10. This setup allows material to be recorded in encoded form and monitored off the tape in decoded form at the same time. Arbitrarily, channels 1 & 3 are assigned for recording and channels 2 & 4 for playback. Since the 122 has only two channels, simultaneous encoded recording and decoded off-tape monitoring can only be accomplished by using two model 122's, one for the encoding and one for the decoding.

OPERATION

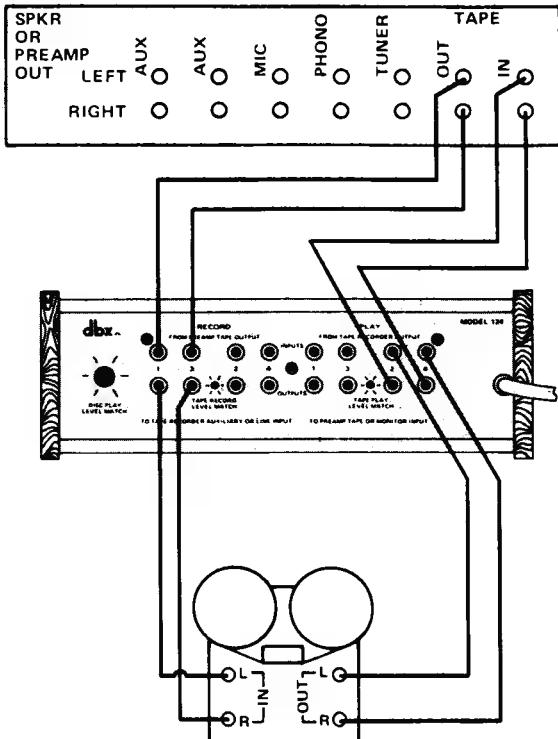


Fig. 10 — Connecting the dbx 124 in a Stereo System for Simultaneous Record and Playback

Setting the Play Level Match and Record Level Match Controls

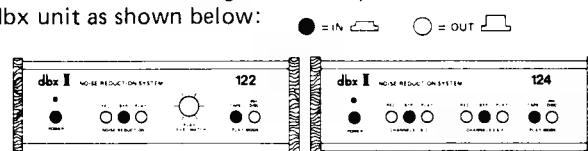
In many cases, a center range setting on these controls will be "just right" (about 12 o'clock), and in no case does the setting affect the linearity of the dbx encode/decode process. However, for listening convenience, the following adjustments can keep record and playback levels the same and can optimize level matching between your preamp, recorder and the dbx unit for the best headroom and lowest noise. The method of setting comparable controls on both the 122 and the 124 is the same, despite minor differences in control function and position.

The Model 122 has a PLAY LEVEL MATCH control on its front panel, a knob that adjusts both tape and disc playback level at the same time. The Model 124 has a TAPE PLAY LEVEL MATCH control (screwdriver adjustable), and a DISC PLAY LEVEL MATCH control (a knob), both located on the 124's rear panel.

The Model 122 and 124 both have screwdriver-adjustable RECORD LEVEL MATCH controls on their rear panels. The 122 has two controls (one per channel), whereas the 124 has but one control that simultaneously adjusts all channels that are switched to REC mode.

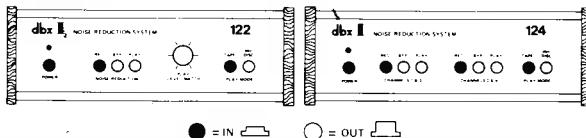
Record Level Adjustments

1. Connect a source of a 1kHz tone (such as an audio oscillator or audio test record) to your preamplifier and set the preamp's TAPE MONITOR switch to SOURCE. If an audio test record or oscillator is not readily available, you can use musical signals of fairly constant level. Set the dbx unit as shown below:



2. Setup your tape recorder for tape recording, but do not record \pm tape (use the recorder's PAUSE switch). Play the source through your system at an average listening level and adjust the tape recorder's input level controls; with \pm test tone, levels should be set for "OVU" on a reel to reel recorder or "-3VU" on a cassette recorder. With program material, only the *peaks* should reach these recommended levels; the *average* VU meter readings should be -2dB to -3dB for reel-to-reel and -4dB to -7dB for cassette recordings.

3. Now reset the dbx unit as shown below:



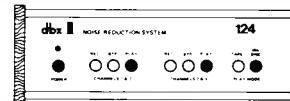
4. Without touching any of the recorder's level controls, adjust the dbx (Tape) RECORD LEVEL MATCH control(s) so that your recorder's VU meters read about the same as they did with the dbx unit in BYP mode. (For program material, the average meter deflections can be made to match those in BYP mode, but the amount the meters move will be cut in half by dbx REC processing.)

Play Level Adjustment

This adjustment is for listening convenience only, and its function is to make the average listening levels from your system about the same whether you are playing conventional sources (dbx in Bypass mode) or dbx encoded sources (dbx in Play mode).

Adjusting the 124's Disc Play Level Match Control

1. Set the 124's front panel switches as shown below:



2. Set your preamplifier as follows: INPUT SELECTOR Switch at PHONO; TAPE MONITOR Switch at TAPE.

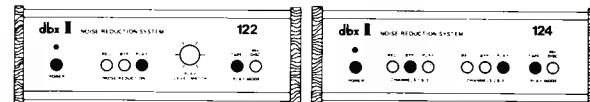
3. Play a dbx encoded disc through your system.

4. Adjust the 124's Disc Play Level Match control so that, on moderately loud passages, the levels are approximately the same when the channel 2 & 4 BYP and PLAY switches are alternately pressed.

Adjusting the 124's Tape Play Level Match Control or the 122's Play Level Match Control

For this adjustment, you will need a source of \pm 1kHz test tone or any dbx II encoded tape. Since the adjustment is for listening convenience only, if you do not have a tone source or \pm dbx encoded tape, you can delay the adjustment until after you record \pm dbx encoded tape.

1. Set the dbx front panel switches as shown below:



2. Set your preamplifier as follows: INPUT SELECTOR Switch at PHONO; TAPE MONITOR Switch at TAPE.

3. Play \pm dbx encoded tape through your system. You can use \pm tape of program material with fairly constant level. For more accurate settings, you can use \pm tape recording of \pm 1kHz tone (taken from an oscillator or a test record). If \pm 1kHz tone is used, the tape need not be dbx encoded.

4. Adjust the dbx's (Tape) Play Level Match control(s) so that on louder passages the levels are approximately the same when the BYP and PLAY switches are alternately pressed. (For the 124 in a stereo setup, switch only the channels 2 & 4 BYP and PLAY switches; in a 4-channel setup, switch both pairs of BYP and PLAY switches.)

dbx Discs

dbx encoding makes it possible to enjoy phonograph discs that are 40dB quieter than conventional discs, with full dynamic range and freedom from distortion. Since dbx encoded discs are cut at lower average levels, your phonograph cartridge can more easily "track" the groove excursions, greatly reducing audible tracking distortion.

dbx discs reproduce loud peak levels that are not practical with standard, conventional discs. Because these loud peak levels can sometimes cause acoustic feedback, you may need to acoustically isolate your turntable from your speaker system; use as much physical separation as possible, a foam mat, or any workable acoustic isolation technique.

If dirt or static electricity build up on dbx discs, they can create noise problems that are not solved by dbx encoding. Since the other normal disc noises are reduced by up to 40dB, dirt and static noises may actually become more distracting. A good quality record cleaner plus an effective static elimination device should solve these problems while prolonging disc and stylus life. After listening to dbx-encoded discs for a while, you'll appreciate and even demand quieter records.

dbx discs can be decoded with the 122, 124 or with any other dbx II system such as the 140 series. However, dbx discs cannot be decoded by dbx professional models, such as the Model 216, or dbx semi-professional models, such as the 150 series. See Page 30 for an explanation of the

difference between dbx professional and dbx II tape noise reduction systems.

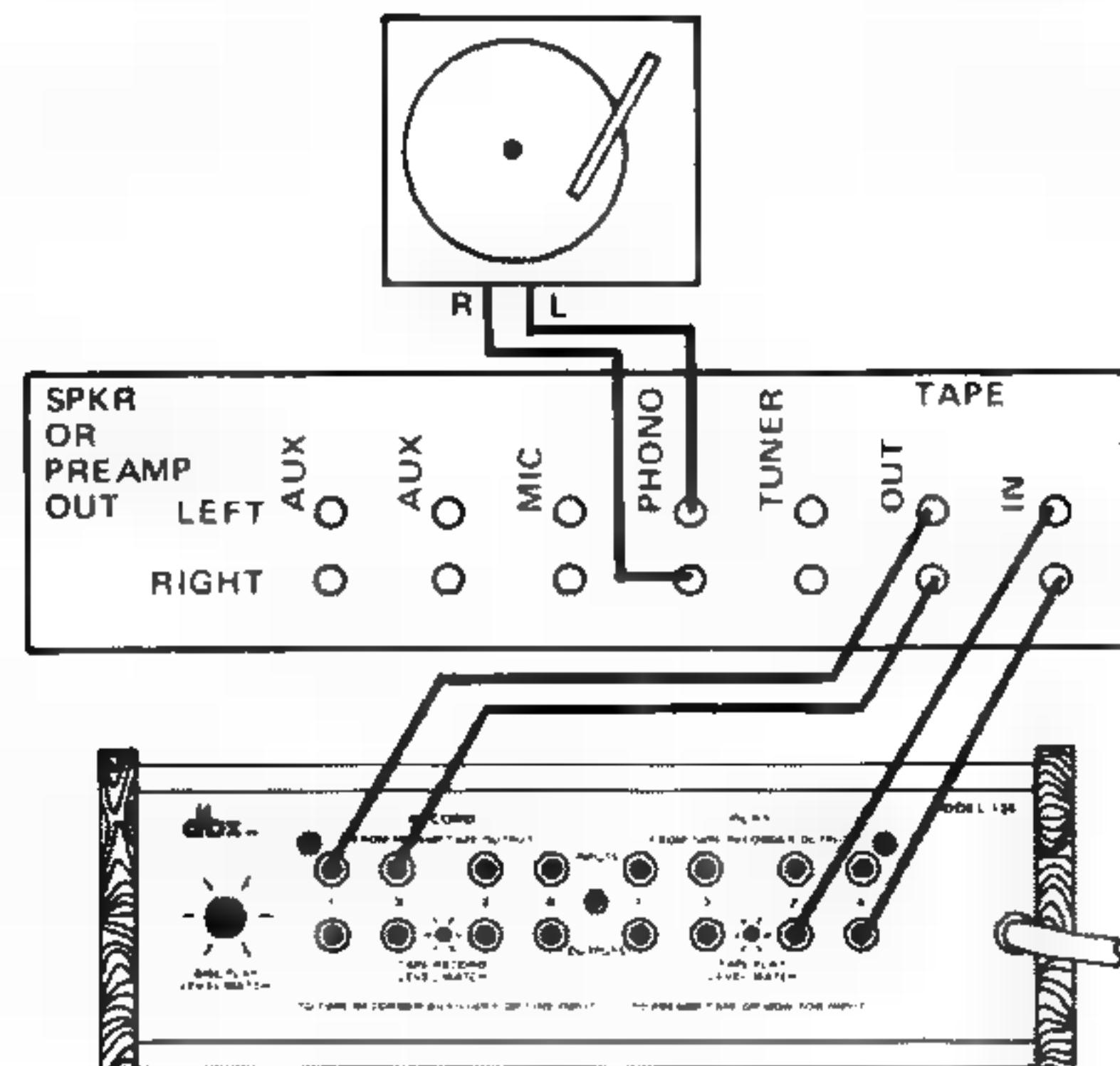
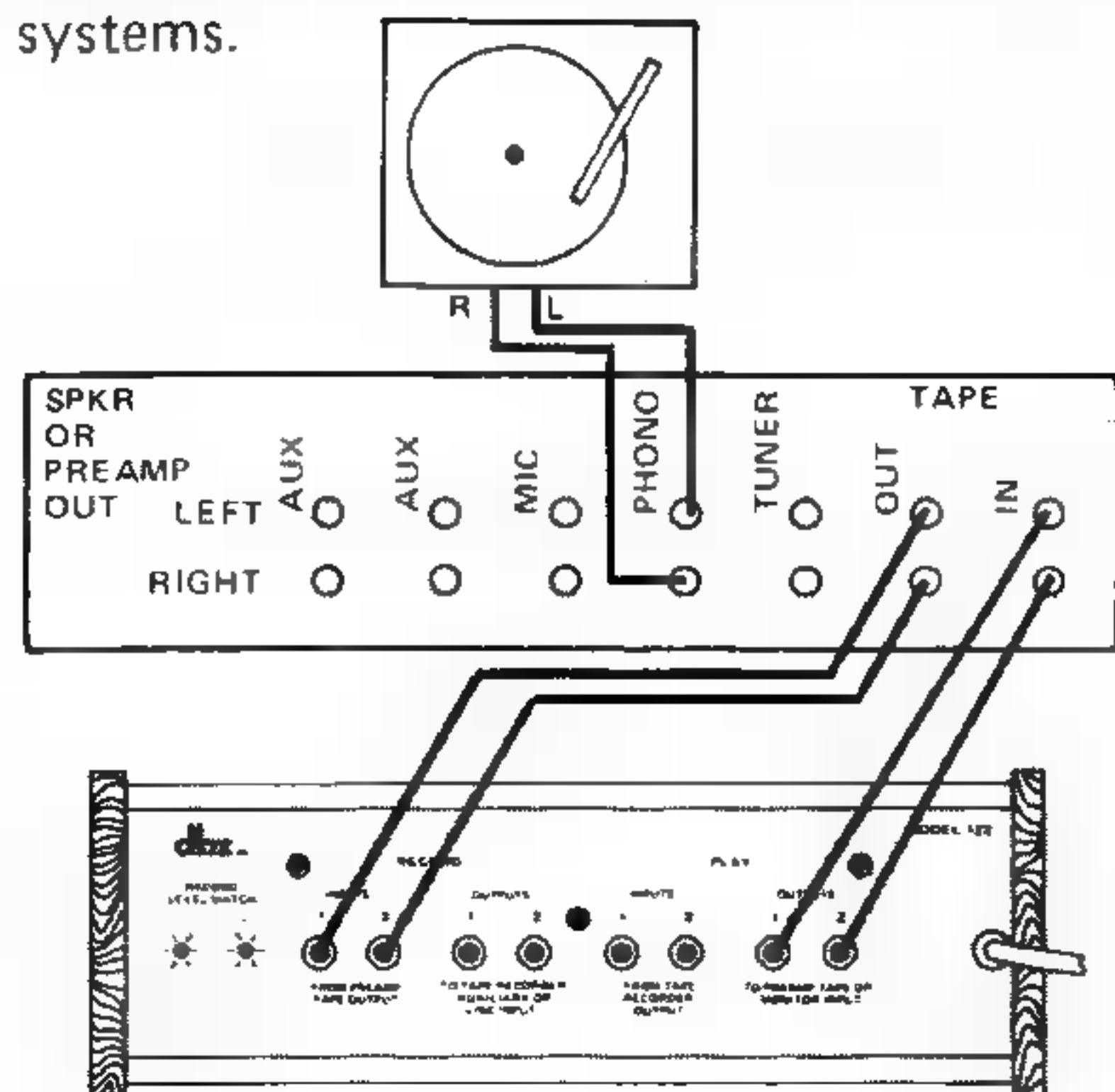
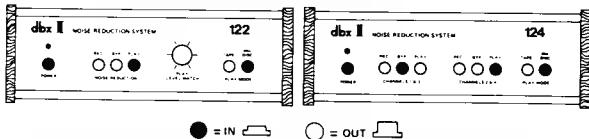


Fig. 11 – Special Connections for dbx-Disc Decoding in Systems without ■ Tape Recorder

How to Decode a dbx-Encoded Disc

- Set the front panel switches as shown below:

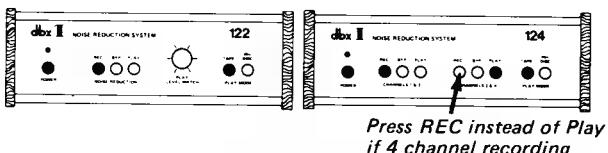


- Set your preamplifier as follows: TAPE MONITOR switch to TAPE, and INPUT SELECTOR SWITCH to PHONO.

- Play the disc.

Making ■ dbx-Encoded Tape

- Set the dbx unit's front panel switches as shown below:



NOTE: Do not change the settings of the Noise Reduction switches while recording since this would ruin your recording.

CAUTION: Never depress the 122's REC and PLAY switches simultaneously. Similarly, never depress the REC and PLAY switches on either pair of the 124's adjacent channels (1 & 3 or 2 & 4). The resulting output could damage your sound system.

- Using an input signal that is similar in level to the program to be recorded, or using the program itself, place your tape machine in Record Ready mode (PAUSE mode) and set the machine's recording level for *maximum VU*

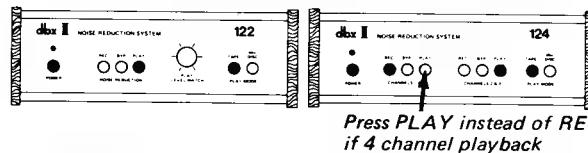
meter readings typically 3 to 6VU lower than normal. (With dbx processing, significantly lower record levels are often required to eliminate tape saturation, particularly in cassette recording. Experiment during initial setup to find the appropriate levels.)

These, or even lower recorded levels may be used with success because the dbx processing prevents audible tape noise.

- Restart the program and start the tape recording. If your system is set up for off-the-tape monitoring with the Model 124, you can monitor the program in decoded form while it is being recorded by switching your preamplifier's TAPE MONITOR switch to TAPE; switching between SOURCE and TAPE gives an "A-B" comparison of original program to the dbx-processed program.

Playing Back ■ dbx-Encoded Tape

- To play back ■ dbx-encoded tape in decoded form, set the dbx unit's front panel switches as shown below:

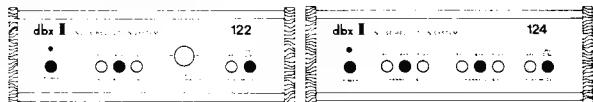


- Place the tape machine in PLAY mode, and your preamplifier's TAPE MONITOR Switch to TAPE. Play the tape normally.

NOTE: If you listen to an encoded recording without decoding, the sound will seem shrill, lacking in bass, and will vary little in loudness. Hiss, hum and other noise will fill momentary pauses in the music. The unpleasant sound of an encoded program is normal, but when decoded, the recording should sound excellent — clean, exciting music against ■ background of silence.

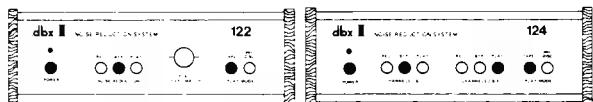
Bypass Mode

To listen to a conventional disc, tape or FM broadcast without dbx processing, simply set your preamplifier's TAPE MONITOR Switch to SOURCE. If your system has no tape monitor loop, or if you wish to bypass the dbx processing for any other reason, set the front panel switches as shown below:



Dubbing (Copying) an Encoded Disc onto ■ Tape in Encoded Form

1. Set the front panel switches as shown below:



2. Set your preamplifier as follows: TAPE MONITOR switch to TAPE, and INPUT SELECTOR switch to PHONO.

3. Set your tape recorder to Record, and record normally.

4. The tape copy will be dbx encoded. With the 124, you will hear the program in decoded form while monitoring this operation off tape.

Dubbing an Encoded Disc onto ■ Tape in Non-Encoded Form

This process is for transferring a dbx-encoded disc in non-encoded form onto a tape for future playback without dbx processing (such as in an automobile tape player).

1. Connect the 122's PLAY OUTPUTS (or the 124's Channels 2 & 4 PLAY OUTPUTS) to your tape recorder's

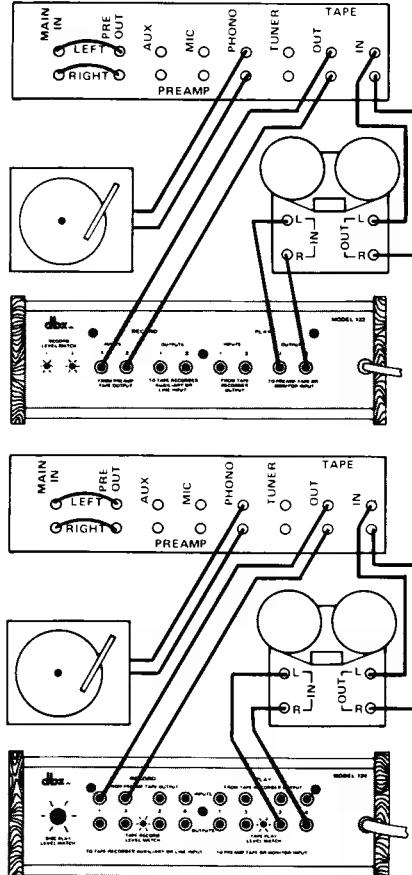
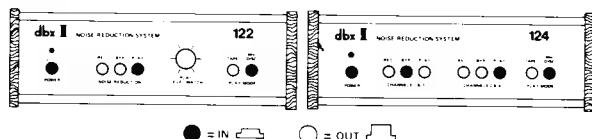


Fig. 12 — Connections for Recording an Encoded Disc onto ■ Tape in Non-encoded Form.

Record Inputs (Aux or Line). The dbx unit's RECORD OUTPUTS and PLAY INPUTS are not used for this process, and it makes no difference whether any cables remain connected to them.

If your tape recorder is equipped for off-the-tape monitoring and you wish to listen to the tape as it is being recorded, you can connect your tape recorder's PLAY OUTPUTS directly to your preamplifier's TAPE INPUTS (Monitor In).

2. Set the dbx front panel switches as shown below:



Copying ■ dbx-Encoded Tape

Making ■ dbx-encoded copy from ■ dbx-encoded master* provides ■ copy with no more audible noise than the master tape.

1. Since the encoded tape does not require additional dbx II processing in order to be copied, the master machine's Play Outputs can be connected directly to the slave machine's Record Inputs.

2. ADJUST THE RECORD LEVELS ON THE SLAVE MACHINE FOR LOWER LEVELS AS IF RECORDING WITH dbx PROCESSING.

3. Tape copies encoded on the 122 or 124 can be played through any dbx II decoder (120 or 140 series), and will

*In the discussion of copying, we use the term "master machine" to refer to the tape machine with the program to be copied. We use the term "slave machine" to refer to the tape machine which is to record the program.

have no more audible noise than the original master tape.

NOTE: Making ■ non-encoded copy from ■ non-encoded master is identical to the procedure outlined above, although average recording levels should be raised by about 3dB.

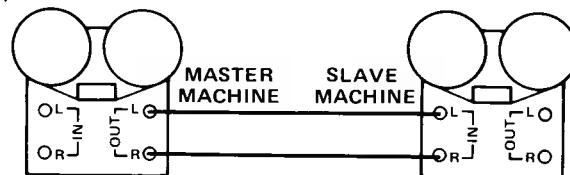


Fig. 13 – Copying dbx-Encoded Tapes or Non-encoded Tapes Directly From One Tape Machine to the Other.

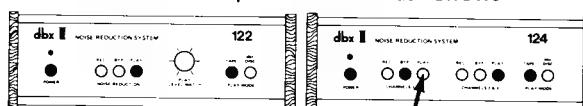
Making ■ Non-Encoded Copy of a dbx-Encoded Master

Making a non-encoded copy from a dbx-encoded master is sometimes necessary so that the copy can be played where dbx II tape noise reduction equipment is unavailable. The copy will be similar to an original recording made without the benefit of dbx processing: in other words, with restricted dynamic range and audible tape hiss.

The encoded master tape (tape A) must be dbx-decoded prior to feeding the slave machine (tape B). This may be accomplished in ■ number of ways depending on the nature of your installation.

If your preamplifier, amplifier or receiver has two tape monitor loops with switching for "Dub A to B" or similar copying provisions, no special connections are required (Figure 14).

1. Set the dbx front panel switches as follows:



Press PLAY instead of BYP
for 4-channel tapes

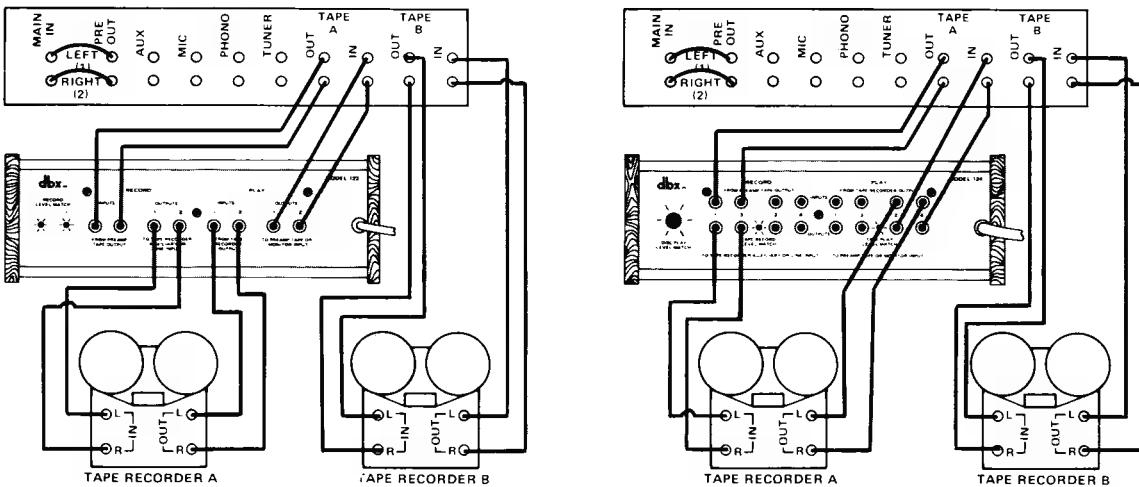


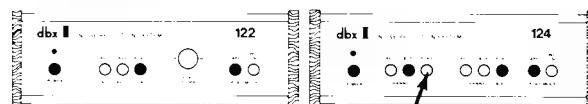
Fig. 14 – Copying dbx-Encoded and Non-Encoded Tapes with ■ Preamp having Two Tape Monitor Loops

2. Set your preamplifier to "Dub A to B" mode, set the "master" tape machine to Play mode and the "slave" machine to Record mode. Peak VU meter readings on the "slave" machine should be the levels used for conventional recording.

If your preamp (or receiver) has only one tape monitor loop, there are two ways to make a non-encoded copy:

1. Either (a) disconnect the dbx PLAY OUTPUTS from the preamp's Tape Monitor Inputs, and connect the cables instead to the slave machine's Record Inputs (Figure 15A), or (b) simultaneously connect the dbx PLAY OUTPUTS to the preamp and to the slave's Record Inputs by using "Y" adapters (Figure 15B).

2. In either case, set the dbx front panel switches as shown below:



*Press PLAY instead of BYP
for 4-channel tapes*

3. Set the "master" tape machine to Play mode and the "slave" machine to Record mode. Peak VU meter readings on the "slave" machine should be the levels used for conventional recording.

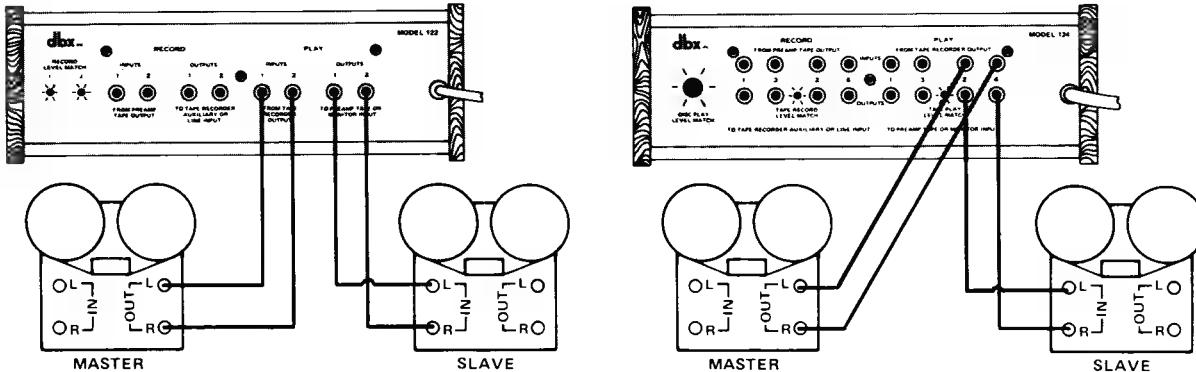


Fig. 15A – Making ■ Non-Encoded Copy from ■ dbx-Encoded Master without the Benefit of Two Tape Monitor Loops (without any preamp)

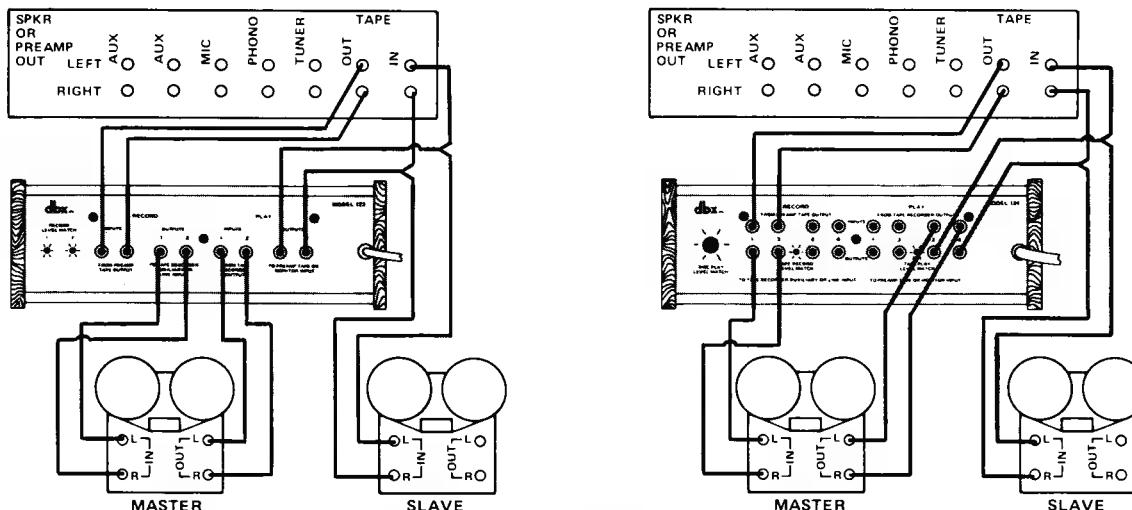


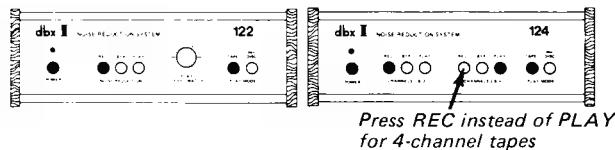
Fig. 15B – Making a Non-Encoded Copy from a dbx-Encoded Master without the Benefit of Two Tape Monitor Loops (using Y-adapter Cables with the preamp)

Making ■ dbx-Encoded Copy from ■ Non-Encoded Tape

Making a dbx-encoded copy from a non-encoded tape is occasionally desirable. The copy will not add any audible noise. This type of copying can be done with the installation described below.

If your preamp (or receiver) has two tape monitor loops with switching for "Dub B to A" or similar copying provisions, no special connections are required. Just connect the system as shown in Figure 14.

1. Set the dbx front panel switches as shown below:



2. Set the "master" tape machine (machine B) to Play mode and the "slave" machine (machine A) to Record mode. Peak VU meter readings on the "slave" machine should be the same as used for dbx processing.

Overdubbing and Sound-On-Sound with the 124

The dbx 124 will both encode and decode simultaneously and thus allows stereo monitoring (or real time source/tape comparison) when used with three head tape machines. Overdubbing and "sound-on-sound" also becomes possible in the two channel format. For example, sound-on-sound is made possible by placing jumper cables between the output of one or two tape recorder channels and the input of another channel or channels. In such cases, the dbx 124 can

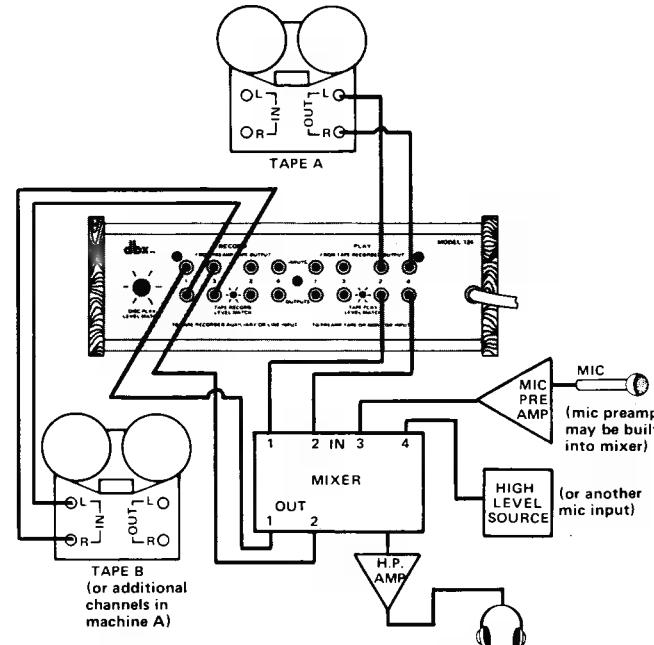


Fig. 16 – Connections for Overdubbing with the 12

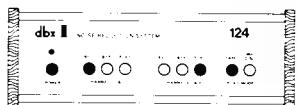
Use ■ "4-In, 2-Out" mixer (a mixer with provision for accepting four input signals and assigning them to either of two outputs).

be inserted in the jumper line, decoding the deck's play output, and re-encoding the record input.

Suppose you wish to add voice to an instrumental track already recorded in stereo (encoded) form. Either a 4-channel tape machine, or two stereo machines are required.

1. For overdubbing, connect your system as shown in Figure 16.

2. Set the 124's front panel switches as shown below:



3. The decoded signal from the 124's Channel 2 & 4 PLAY OUTPUT jacks feeds two of the inputs on the mixer. Use any quality commercial, line-level mixer.

4. The voice signal (signal to be added) feeds a third mixer input. Since microphone signals are generally low level, the microphone must be preamplified by a good quality mic preamp, which may already be built-in to the mixer, if it is commercial type. Inexpensive, battery-powered mic preamps are available from many electronics stores and hi-fi dealers.

5. The mixer output feeds the 124's Channel 1 & 3 RECORD INPUTS. To balance the original and added signals as you record the tape, use the mixer's volume controls and monitor the balance at the mixer's headphone output or at your tape recorder headphone output. If necessary, add an additional headphone amplifier, as shown.

6. The encoded output from dbx channels 1 & 3 feed the remaining two tracks of the 4-channel tape machine, or to feed the second stereo tape machine.

It's possible to perform multi-channel sound-on-sound mixes with the 124 and an inexpensive passive mixer if the material to be processed is re-recorded one channel at a time. Connect the 124 in a similar manner to that shown in Figure 17, using the passive mixer shown, constructed in a metal box.

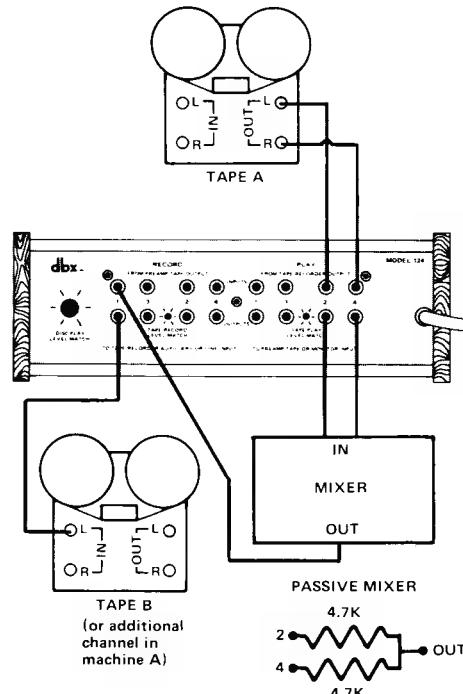


Fig. 17 — Mixing Two dbx-Encoded Channels to One Track while Maintaining dbx Encoding (for sound-on-sound)

Signals are first decoded, then mixed together and re-encoded. A passive mixer may be built using two 4.7k-ohm resistors, as shown. **DO NOT mix signals unless they are first decoded; mixing encoded signals will cause inaccurate decoding later.**

HINTS TO GET THE MOST OUT OF dbx NOISE REDUCTION

Mixing

Individual channels which have been dbx-encoded cannot be mixed together unless they are first individually decoded. In fact, encoded tapes must be decoded before limiting, equalization, or any other special signal processing angles).

levels (as displayed on your tape will be somewhat lower with the dbx), and minimum levels will be higher. J meter on the tape recorder will not (if any) on the preamp or mixer. ie 2:1 compression. The average e tape recorder should generally be -10VU and -3VU when recording his level allows plenty of headroom of tape saturation, and it es adequate separation from the

to increase record levels to "take d level (High Output Low Noise) sirable to retain standard record and extra headroom for truly accurate transient response. The extra few dB of recorded level are not necessary because dbx processing avoids residual tape noise even with standard tapes. We recommend the new smooth-surfaced tapes (calendered tapes) which have inherently lower noise.

Bias, Equalization and Alignment

Hiss level in tape recording is a function of the recorded signal level as well as bias level. In order to minimize tape modulation noise, it is important that the tape machine be

properly biased for the particular tape used. If your tape machine has bias and equalization switches or adjustments, experiment to find the settings that yield the lowest tape modulation noise and the best frequency response with dbx encoding and decoding.* Proper head alignment is also important because the 2:1 expansion of the dbx decoding can exaggerate any frequency response errors in the tape record/playback process. In addition, always keep your tape heads clean and demagnetized to avoid extra noise and distortion. Correct bias, equalization and alignment are important for any recording, but are especially important to get the most out of recording with dbx processing.

Effects

When recording with dbx II tape noise reduction, use limiting and compression for special effects only. The dbx encoding process makes routine limiting and compression completely unnecessary. (As stated in the hint "Mixing," any such signal processing would be done before encoding, if at all.)

Microphones and Pickups

When making live recordings from microphones or instrument pickups, the signal level must first be pre-amplified before being applied to the dbx's RECORD INPUT jacks. A low noise preamplifier should be used to take full advantage of the noise reduced recordings. If your tape machine has mic preamplifiers, these cannot be used because they would bypass the dbx encoding. Some stereo receivers have mic preamps, which may be used since they come before dbx encoding, and there are relatively inexpensive battery powered mic preamps, too.

Coughs, shoe scuffs, and similar sounds which may

*See Page 32 for a discussion of tape modulation noise.

never have been audible in conventional recordings can become an annoyance when captured on a quiet dbx recording. For this reason, the ambient room noise should be held to an absolute minimum.

Subsonics and Interference

The dbx 122 and 124 incorporate very effective band-pass filters that maintain full frequency response throughout the audible spectrum (-3dB at 27Hz and at 27kHz). Their purpose is to reduce subsonic and supersonic (bias) frequencies which might otherwise introduce errors in the encode or decode process. However, in some extreme cases, rumbles from passing trains, trucks, aircraft, or even air conditioning may be picked up by your microphones and fed to the dbx's encoding circuitry.

These subsonics can cause the rms level detector to modulate the program, even though the low frequencies themselves are not audible and are not recorded on the tape (a tape machine usually cannot record accurately frequencies below 30Hz). As a result, the low frequency information that created encoding changes is missing upon playback so the decoder is "fooled." The result may be a mysterious and unwanted deviation in program level.

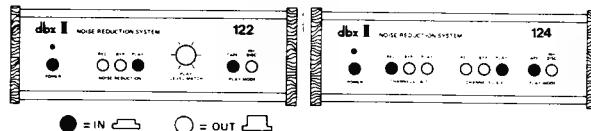
Should you encounter this rare problem, it can be eliminated by using a high pass filter between the microphone preamplifier and the dbx RECORD INPUT; the LOW CUT, SUBSONIC or RUMBLE filter on your preamplifier may be suitable, although on some preamplifiers the cut-off frequency may be higher than necessary. If unexplained playback level deviations occur after copying a conventional phonograph disc onto a tape (using dbx II tape noise reduction encoding), use of the RUMBLE filter during recording will solve the problem by cutting subsonic frequencies.

When to Use dbx II Tape Noise Reduction Plus Expansion

By recording and playing back a program with dbx II tape noise reduction, then expanding it with a dbx dynamic range expander such as our Model 3BX or 118, you can reduce the noise and increase the dynamic range of the original program source. This process is especially effective on FM broadcasts or noisy phonograph discs. By itself, the dynamic range enhancer can lower the noise and increase the dynamic range of conventional (non-dbx-encoded) phonograph discs, FM programs, pre-recorded tapes or other sources. Together, the dbx II tape noise reduction system and the dbx dynamic range enhancer can significantly increase your listening pleasure. The dbx Model 128 is a combination unit containing basically the same circuitry as the Model 122 (dbx II tape noise reduction unit) and the Model 118 (dbx dynamic range enhancer).

How to Playback with Expansion

1. Connect your system as shown in Figure 18.
2. Set the 122 or 124 as shown below:



3. Set your preamplifier's TAPE MONITOR Switch to the TAPE position and select AUX.
4. Set the dbx dynamic range enhancer's controls for the desired degree of expansion (as suggested in that unit's owner's manual).

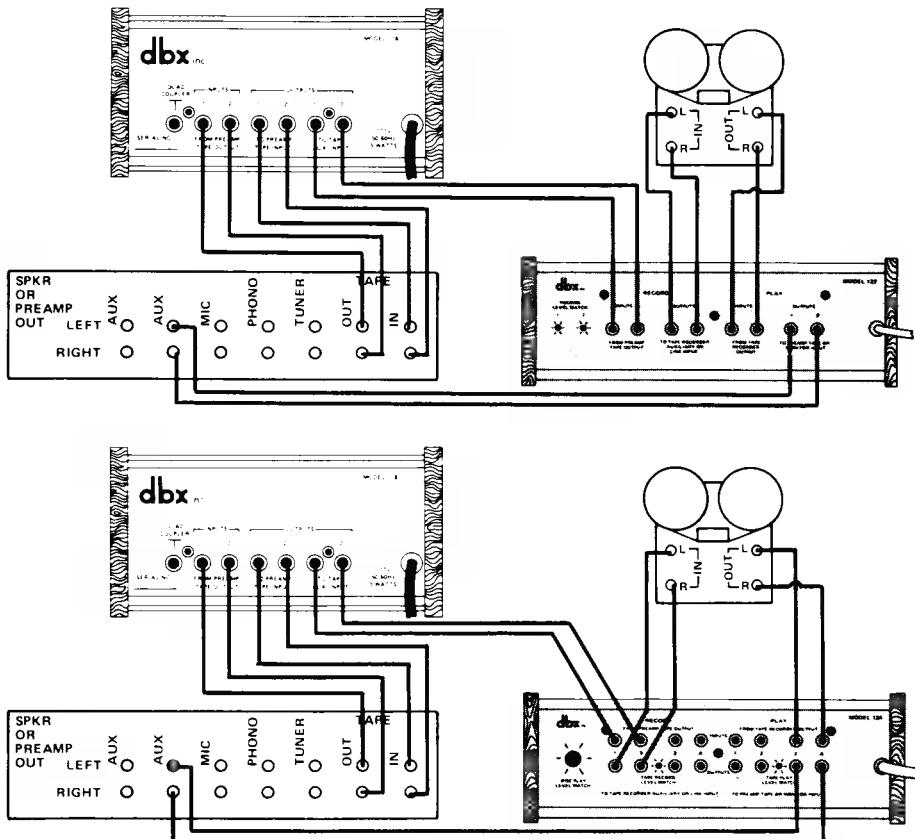


Fig. 18 – Using the dbx 118 in conjunction with a dbx 122 or 124 Tape Noise Reduction System

(The 118 is illustrated, but any dbx-dynamic range enhancer is suitable.) This setup is ideal for expanding the dynamics of a conventional phonograph disc or an FM broadcast and then making a low-noise, wide dynamic range recording of that program.

HOW dbx II TAPE NOISE REDUCTION WORKS

A Short Explanation

To reduce tape noise, the dbx 122 and 124 utilize a sophisticated version of the classical compressor/expander (compander) concept. The RECORD processor compresses the input to the tape recorder by a 2:1 ratio, linear over a 100dB range. Upon playback, the PLAY processor provides 1:2 expansion of the recorder's output. The expansion is a mirror image of the compression so the recorded signal cannot be distinguished from the original audio source, full dynamics are preserved, and virtually no audible tape noise is added.

Consider a 100dB program which might have loud peaks at +18dBm and quiet passages as low as -82dBm. If the tape recorder has a maximum input level of +15dBm before distortion and a residual noise level of -40dBm, in other words, a 55dB S/N ratio which is typical of many good hi-fi and semi-pro tape machines, there is no way the original program dynamics can be captured on tape; peaks will be lost due to saturation, or quiet passages will be lost in the noise, or a combination of both. dbx encoding will solve this problem by bringing the maximum signal level down to +9dBm, and by raising the minimum level to -41dBm so the recorded program would fall within the usable dynamic range of the tape. (See Figure 19.) That is, the quietest signal remains above the noise and the loudest signal remains below the point of tape saturation.

NOTES:

1. Maximum input levels on tape recorders are specified at the 3% harmonic distortion point. Because dbx encoding lowers maximum recorded levels, it greatly lowers distortion

at the same time it eliminates audible noise.

2. The term "dB SPL" refers to the acoustic sound pressure level. The term "dBm" refers to the level of "sound" while it is in electrical form. dB is a relative term, and there is no direct equivalence of dB SPL to dBm,

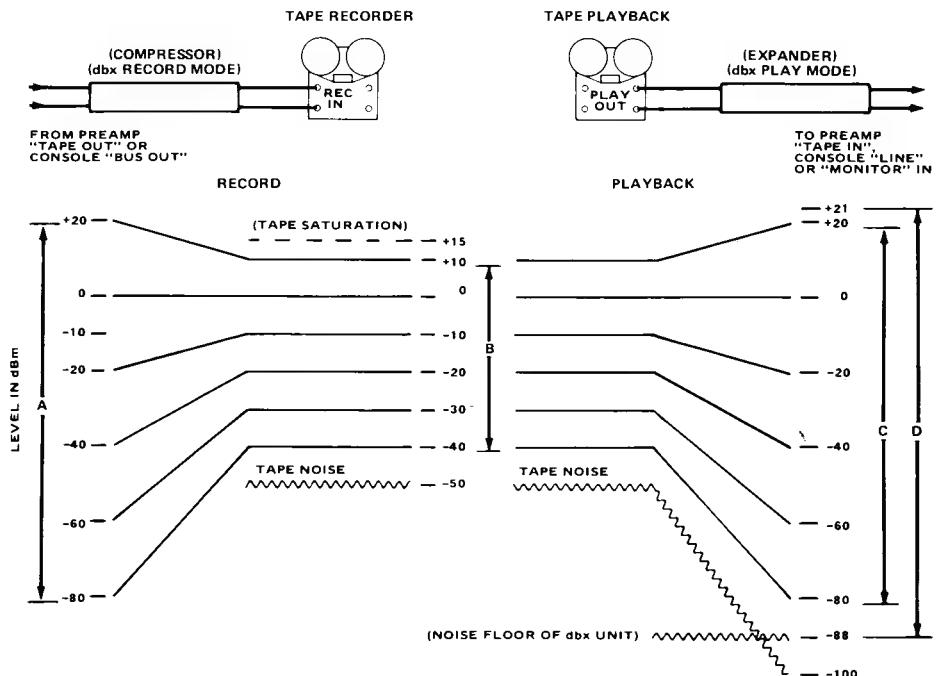


Fig. 19 – How the dbx System Works

A. Typical program of wide dynamic range (about 100dB).
 B. 2:1 compressed program (encoded) reduces dynamic range by half, so that signal can be placed below the tape saturation level and above the tape noise level.

C. 1:2 expanded program (decoded) restores the original dynamic range (100dB). Tape noise is always well below the quietest part of the program.

D. Dynamic range of the dbx compressor and expander is about 100dB.

although the terms are proportional. That is, an electrical increase of 1dB in an amplifier will create an acoustical increase of 1dB SPL in front of the speakers. Thus, a live program which increases from 50dB SPL to 100dB SPL, when translated to an electrical signal by a microphone, might go from -40dBm to +10dBm . . . still a 50dB increase in program level.

When the encoded recording is played through the dbx PLAY circuitry, expansion increases the level of the louder passages and decreases the level of quieter ones. In the preceding example, the +9dBm recorded level would be restored to +18dBm, the -41dBm level would be restored to -82dBm, and all other levels in between would be proportionately restored (See Figure 19). The tape noise is also subject to expansion, and it drops from -40dBm to -80dBm . . . to inaudibility. This type of processing for tape recording is far more effective than filters which operate only during playback of conventional recordings (like the rumble and scratch filters on your receiver or amplifier). Moreover, such playback-only filters may cut off the higher frequency program harmonics in order to reduce hiss, whereas dbx II processing retains the full frequency spectrum of the original program.

Many attempts have been made to apply the classical compression/expansion concept to tape noise reduction, but most of these have been less than successful for technical reasons. The dbx approach, however, is unique. A voltage controlled amplifier (VCA) serves as the gain control element, and a true rms (root-mean-square) level sensing detector insures perfect encode/decode tracking for accurate transient response . . . regardless of phase changes that may be induced by the tape machine. Moreover, there is no audible breathing, pumping, or other coloration of the sound. Critical level matching is not needed because

the dbx system encodes and decodes accurately despite differences in record and playback levels.

The Two dbx Systems: dbx (professional) and dbx II

The original dbx noise reduction system was developed for use in professional recording studios. With the increasing popularity of dbx noise reduction in models like the 4-channel 187 and the 16-channel 216, many home recording enthusiasts sought better quality tapes. In response to the demands of consumers and small studios, dbx introduced a variety of semi-professional units (the 150 series). These units utilize the same signal processing as the professional recording studio models, so tapes made with the professional series may be decoded with the semi-professional series, and vice-versa.

Broadcasters realized the potential for improved signal quality if they could use dbx processing. However, broadcast cartridges and telephone transmission lines do not offer the excellent frequency response available in professional recording studios and in better hi-fi tape machines; the low and high end of the frequency spectrum often fall off considerably. With the dbx professional system, poor high and low frequency response in a tape recorder can cause mistracking of the rms detection circuitry. Also, the rumble and low frequency errors of warped discs, or the limited low and high frequency response of telephone and microwave transmission lines would create mistracking of the rms detection circuitry. Therefore, the dbx II system was developed, represented by dbx Models 122, 124, 128 and the 142. The basic principle of operation of dbx professional and dbx II are identical, and the amount of noise reduction is the same, yet the two systems are not compatible. A tape encoded with either system cannot be decoded by the other. Similarly, a dbx encoded disc (dbx II processed) cannot be decoded with the original dbx

professional system.

The two systems were designed for different applications. The bandpass filter in the signal path in the dbx II system is slightly more restrictive, rolling off 1dB at 30Hz. In addition, the rms detection circuitry in dbx II units is sensitive only up to 10kHz, so high frequency losses on the tape or transmission lines will not create encode/decode mistracking. THE OVERALL FREQUENCY RESPONSE OF dbx II PROCESSING DOES COVER THE ENTIRE AUDIBLE SPECTRUM.

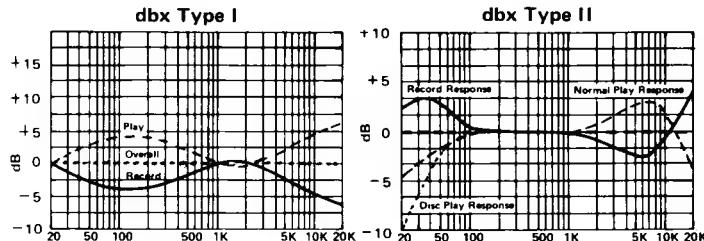


Fig. 20 — Comparison of dbx Type I and Type II Processing

Type I is the curve used in the 152, 154, 157 and 158 as well as professional recording studio dbx equipment. Type II is the curve used in the 128, 122, 124 and 140 series, which is optimized for such applications as broadcast and disc noise reduction, as well as tape recording.

The dbx II system is also equipped with a TAPE/DISC switch that introduces a further low end roll off (-3dB @ 30Hz) in DISC mode. This has been provided to permit decoding of special dbx encoded phonograph records; the roll off protects the rms detection from mistracking due to record warp or turntable rumble. The dbx II system is especially suited to noise reduction with cassette and

cartridge recorders which have limited frequency response compared to a professional studio machine.

Changes in the pre-emphasis and de-emphasis curves also distinguish the dbx professional and dbx II systems. However, both systems offer the same 30dB of broadband noise reduction, and a 10dB improvement in headroom for tape recordings. The signal processing differences between dbx professional and dbx II make it inadvisable to encode with one system and decode with the other; audible tracking errors could occur.

SYSTEM PERFORMANCE

32

Close scrutiny of a dbx processed tape will demonstrate that its frequency content is virtually identical to that of the original source. However, the first impression of ■ dbx II processed tape, when compared with a non-dbx II processed tape, may seem to indicate that the non-processed tape has better high frequency response. This apparent contradiction can be explained by realizing that the ear has interpreted the hiss of the non-processed tape as additional high frequency content.

There can be some barely audible imperfections, even after dbx tape noise reduction processing, which are due to tape asperity noise with some types of very clear signals.* Unfortunately, these noise components lie in the same frequency region as the dominant signal energy, hence we must look to improvements in tape technology for their reduction . . . regardless of the noise reduction system in use. Incidentally, these asperity noise components can be masked, almost completely, by ■ steady hiss. The required level of this "noise perfume" is about -65dBm. It is no coincidence that noise reduction systems such as Dolby A, Dolby B, and A.N.R.S., which claim "absolutely no audible effect," have this residual noise present in the output (dbx output noise is below -88dBm).

By taking advantage of dbx noise reduction in live recording, not only will there be no hiss, there also will

*Asperity noise is a random noise that is caused by minute imperfections in the magnetic coating of the tape. Due to surface irregularities and magnetic particles that vary in size, tape becomes more or less magnetized in a given field from the recording head, causing a random noise to be superimposed on the recorded signal. The noise due to this non-homogeneous coating cannot be subtracted from the signal by compander processing. Improvements in tape manufacturing processes could reduce asperity noise. To draw ■ rough analogy, asperity noise is to ■ taped program as grain is to a photograph.

be full dynamics in the live recording. Moreover, the distortion that would otherwise have been introduced by tape saturation or transient overload will not be present to degrade the audio quality.

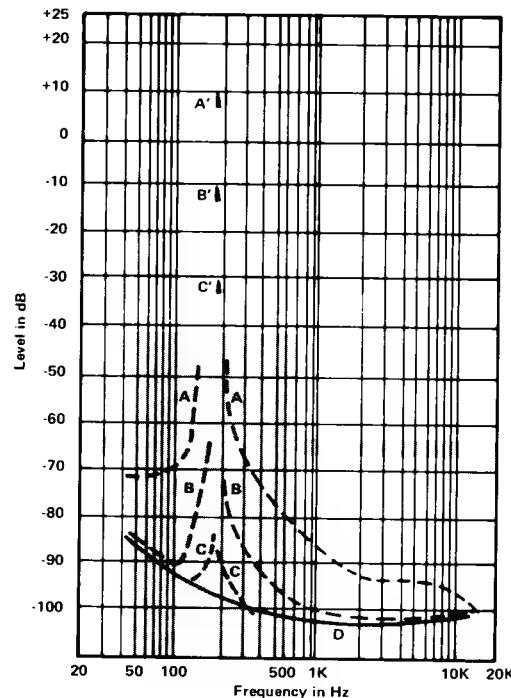


Fig. 21 — Tape Noise Characteristics (description next page)

TECHNICAL DETAILS OF dbx PROCESSING

Asperity noise yields the curve shown by "D." The recorded signals (A', B' and C') are all sine waves at 180Hz. The noise sidebands created by these signals are illustrated by curves A, B and C. Observe that the higher the recorded signal level, the higher the noise sideband level. This level dependent noise is known as tape modulation noise.

The noise sidebands are masked partially by the recorded signal, but only for about two octaves on either side of the signal. This masking is depicted by the shaded box in the chart. The ear is less sensitive to lower frequencies, so the lower sidebands are masked sufficiently by the signal. Notice the upper sideband of the +10dBm recorded signal (curve A) extends beyond the masked area and at a level which would be audible in a program of 100dB dynamic range.

To negate modulation noise effects, dbx applies pre-emphasis to the signal before recording and de-emphasis upon playback. The de-emphasis starts at 400Hz, and reaches a maximum weighting of -12dB at 1600Hz (See Figure 22-F). The net result is a reduction in modulation noise of nearly 12dB with strong low frequency recorded signals, while the overall record/play frequency response is flat.

The shaded line at -65dBm indicates the level of steady state background noise which would be required to mask modulation noise if pre-emphasis and de-emphasis (or signal weighting) were not used. With signal weighting, there is no need for this "noise perfume" as used in other compander systems.

Level Detection

Regardless of the specific techniques employed by a given compander-type noise reduction system, some method must be used to sense the audio input level to the compressor (when recording) and to the expander (when playing back) (Figure 22). This level detection circuitry tells the compressing or expanding amplifier the actual input signal level, and then the amplifier's gain increases or decreases to accomplish the required expansion or compression (Figure 22 — 6 & 6A). In theory, the basic principle of operation is simple, but in practice, the difficult part is to maintain precise mirror image encoding and decoding. In other words, whatever degree of compression takes place during the encoding must be precisely matched by the same degree of expansion during decoding . . . and at the same point in time with respect to the program. There are several ways to detect signal level, and some make it difficult to assure mirror image encode/decode performance (tracking).

Previous attempts to create compander type tape noise reduction systems have utilized peak and average level detection, both of which are sensitive to phase changes. Phase changes are inherent in tape recording due to characteristics of the record heads, electronics, and tape, so level detection schemes which are phase sensitive are subject to mistracking errors upon decoding. That is, the amount of expansion does not correspond with the original compression so the retrieved program does not sound exactly like the original one. Unlike peak and average level detection systems, the rms method sums the squares of the instantaneous energy of all frequency components present. Therefore, rms detection is impervious to phase changes. However, true rms detection has been very complex and expensive. dbx equipment uses our own recently

developed and patented analog techniques to achieve excellent rms detection at a moderate cost.

Bandpass Filtering

To further improve the performance of the dbx system, bandpass filters are placed in the signal path, restricting the response to the audible frequency spectrum. This does not degrade the audio signal's frequency response in any way. Bandpass filters are also placed in the rms level detection path (Figure 22 – 1, 4 & 4A) so that subsonic and supersonic signals (such as air conditioning noise or tape bias noise) are less likely to create encode/decode mistracking.

Fig. 22 – Block Diagram of dbx II Noise Reduction Circuitry

The functions are explained in the text and on the following pages.

A. The Signal Bandpass Filter

With a 3dB roll off at 27Hz and at 27kHz, this filter prevents non-recordable signals from entering the dbx record processor. It does not affect the audible spectrum, but it does avoid encode/decode mistracking by preventing subsonic and supersonic signals from entering the compander.

B. Record Signal Pre-Emphasis

A high frequency boost that matches reciprocal high frequency reduction upon decoding (curve F), thereby reducing modulation and asperity noise.

C. Level Detector Bandpass Filter

The same filter is used for encoding and decoding, and rolls off 3dB at 27Hz and 10kHz. The filter affects only the rms level detection, preventing expansion and compression circuits from reacting to subsonic or supersonic signals or from being misled by poor frequency response in the tape recorder at the extremes of the audio spectrum. This avoids encode/decode mistracking without affecting overall signal frequency response.

D. RMS Level Detector Pre-Emphasis

The same rms Level Detector pre-emphasis curve is used for encoding and decoding. It complements the signal pre-emphasis and de-emphasis curves, avoiding excessive high frequency levels which might otherwise cause tape saturation or self erasure.

E. Overall Record Processing (Encode) Response

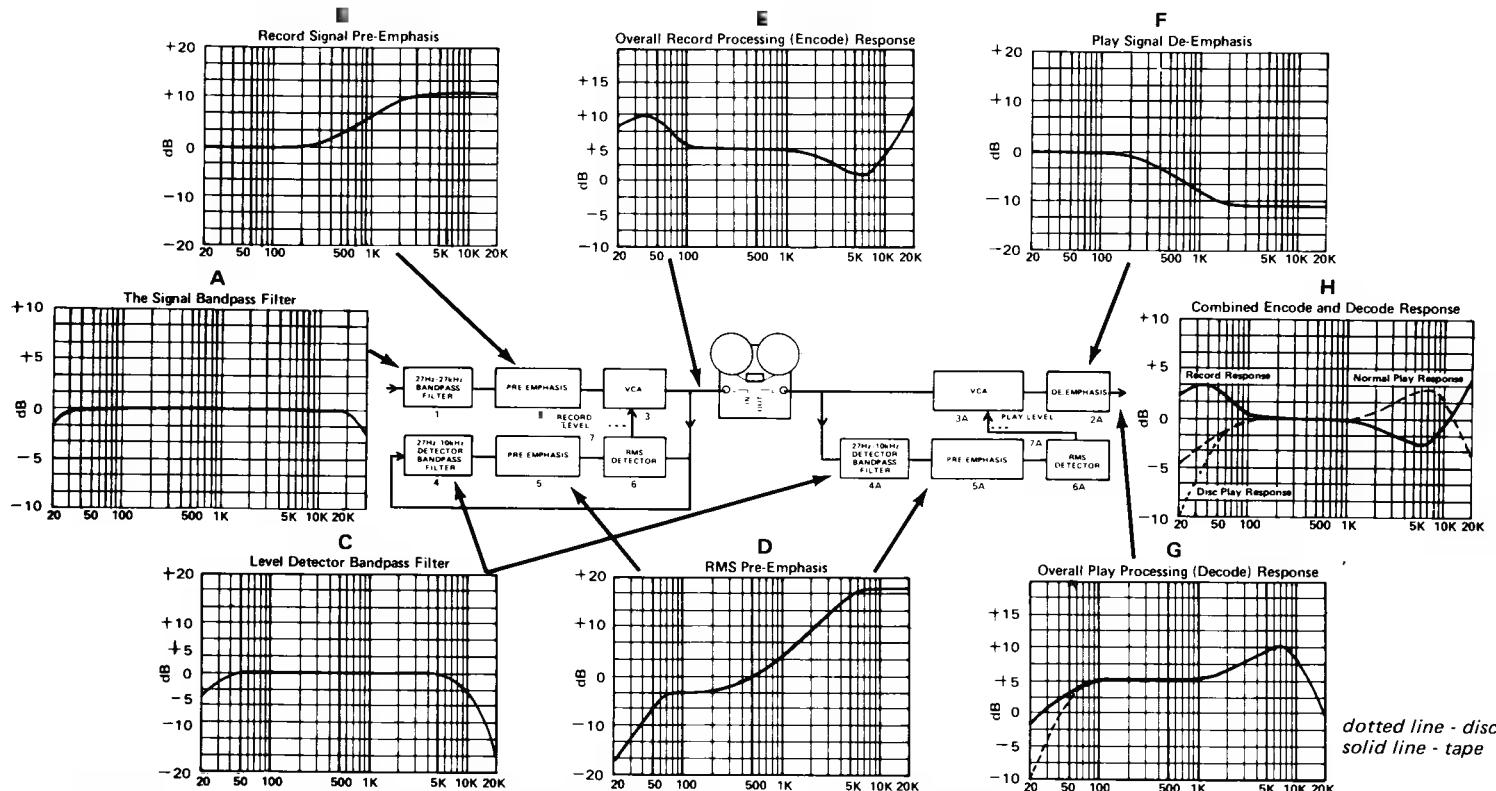
This is the single sine wave response of the encoding circuitry. Given a nominal level input at the dbx input (a sine wave signal swept across the audible spectrum), this is what the dbx record output will do. Note that the overall encode and decode response (curve H) is essentially flat.

F. Play Signal De-Emphasis

The complementary curve for the record signal pre-emphasis (curve B), containing a high frequency roll off to reduce modulation and asperity noise components by some 12dB.

G. Overall Play Processing (Decode) Response

This is the single (swept) sine wave response of the decoding circuitry. Given a nominal level input at the dbx input (a sine wave



signal swept across the audible spectrum), this is what the dbx play output will do. Note that the overall encode and decode response (curve H) is essentially flat, a combination of the PLAY and RECORD response (curve G).

H. Combined Encode and Decode Response

This is the combined effect of encoding and decoding. The curve shows that the net result of dbx processing does not change the frequency content of the program. The only thing missing is the noise and much of the distortion that would otherwise be introduced as a result of the tape recording process. (Note: Play curve's vertical scale is corrected for the 1:2 expansion factor.)

Pre-Emphasis and De-Emphasis

Tape modulation noise is a phenomenon that occurs with all tape recordings. It consists of noise sidebands which appear on either side of the signal which is being recorded, and it is caused by inherent characteristics of the tape. Modulation noise levels are significantly higher than the residual background noise of the tape, although the modulation noise falls off as the frequency moves away from the recorded signal. The signal masks modulation noise components that lie nearby in frequency, but it does not mask noise which is several octaves above. For this reason, modulation noise is most often a problem when a strong, low frequency signal is recorded. (What might be heard, for example, is a low organ or bass guitar note that is accompanied by a rushing, hissing sound . . . as the note dies, so does the noise). dbx applies pre-emphasis and de-emphasis to reduce modulation noise by up to 12dB (Figure 22 – 2 & 2A).

Levels

When using linear compression and expansion there is no threshold at which the compression and expansion takes place. Therefore no pilot tones or routine calibration are required. The 122 and 124 are provided with REC LEVEL MATCH controls, and PLAY LEVEL MATCH controls. These controls adjust the dbx record and play gain to correspond to the nominal levels of your equipment. These level adjustments let you maintain the same levels in record, play and bypass modes for monitoring convenience. Level matching is not essential for proper encode/decode tracking. (Refer to Page 15 for level adjustment information.)

SPECIFICATIONS

DYNAMIC RANGE	(Weighted background noise to peak signal ratio) 110dB.
INPUT IMPEDANCE	50k-ohms
OUTPUT IMPEDANCE	Designed to feed recorder and preamp inputs of 5k-ohms or greater.
MAXIMUM OUTPUT LEVEL	7 volts rms at 1kHz into ■ 5k-ohm load.
EFFECTIVE NOISE REDUCTION	30dB for tape recorders with signal to noise ratios of 45dB or better. 40dB for dbx encoded discs (A weighted).
COMPRESSION-EXPANSION SLOPE	2:1 constant linear decibel.
TRACKING ACCURACY	±1dB per 20dB for complete encode-decode cycle.
FREQUENCY RESPONSE	±0.5dB 50Hz to 15kHz; ±1dB 30Hz to 20kHz (single sine-wave encode-decode cycle). ±0.25dB 30Hz to 20kHz (for complex music program). -3dB at 20Hz (for tape noise reduction). -3dB at 27kHz (for disc decode mode).
HARMONIC DISTORTION	2nd Harmonic: less than or equal to 0.1% encode-decode from 30Hz to 15kHz. 3rd Harmonic: less than or equal to 0.1% encode-decode from 100Hz to 15kHz. 3rd Harmonic: less than or equal to 0.5% encode-decode from 30Hz to 100Hz.
IM DISTORTION	0.15% typical; 0.3% maximum for encode/decode cycle. (60Hz & 7kHz 4:1 SMPTE)
IMPULSE RESPONSE	Risetime: less than 20 microseconds Overshoot: 12dB for 1kHz tone burst Release rate: 240dB/second
LEVEL MATCH RANGE	100mV to 3V for unity gain; adjustable for convenience in level setting and avoidance of overload in succeeding audio stages; level match setting unimportant for encode-decode tracking.

NOTE: Above measurements at 1 volt rms input and output.

Specifications are subject to change without notice.

DISCUSSION OF SPECIFICATIONS

Useful dynamic range, in the dbx 122 and 124 specifications, is defined as the difference between the units' weighted background noise and the peak signal encountered. For both units the dynamic range is 110dB. How much of this range your system is capable of recording and playing back depends on the quality of your recorder and its associated electronics. The specification implies a recorder with 60dB signal-to-noise ratio and it implies that the dbx RECORD LEVEL match control(s) have been accurately adjusted. For a recorder having a 45dB minimum signal-to-noise ratio, it is possible to extend the signal-to-noise to 70dB.

Encode-decode frequency response also depends on your recorder. Frequency response will be smoother with better recorders since the dbx noise reduction system tends to multiply frequency response errors in a poor quality tape recorder. The dbx unit itself is capable of 30Hz to 20kHz response, ± 1 dB, and is within ± 0.5 dB between 50Hz and 15kHz.

Encode-decode harmonic distortion consists primarily of low-frequency third harmonics and is the result of the need for the encoder to rapidly track changing input signal levels. At very low frequencies, the system may track sinusoidal inputs as if they were music envelopes. The better the tape recorder low frequency response, the better this specification will be, since it is the nature of the dbx noise reduction system to cancel low frequency harmonic distortion on playback if the low frequency information is still present.

There is an honest question about the importance of this specification, not only because it must allow for unpredictable tape recorder non-linearities, but also because at low-bass frequencies loudspeaker distortion may reach as high as 10 percent. Above about 200Hz, the dbx's harmonic distortion typically is less than 0.1%.

The dbx 122 and 124 will produce 7 volts rms into a 5k-ohm load. Thus, they will drive the inputs of several high-impedance tape recorders at the same time.

dbx PRODUCT WARRANTY

All dbx products are covered by a limited warranty. Consult your warranty card or your local dealer for full details.

FACTORY SERVICE

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The dbx Customer Service Department is prepared to give additional assistance in the use of this product. All questions regarding interfacing dbx equipment with your system, service information or information on special applications will be answered. You may call during normal business hours — Telephone: (617) 964-3210, Telex: 92-2522, or write to:

**dbx, Inc.
71 Chapel Street
Newton, MA 02195**

Attn: Customer Service Department

Should it become necessary to have your equipment factory serviced:

1. Please repack the unit, including a note describing the problem along with the day, month and year of purchase.

2. Send the unit freight prepaid to:

**dbx, Inc.
224 Calvary Street
Waltham, MA 02154**

Attn: Repair Department

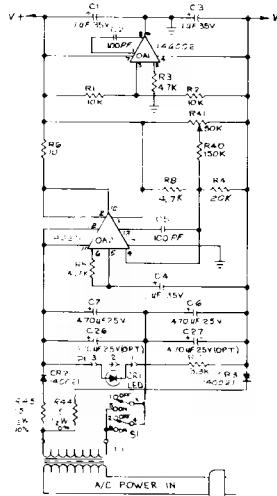
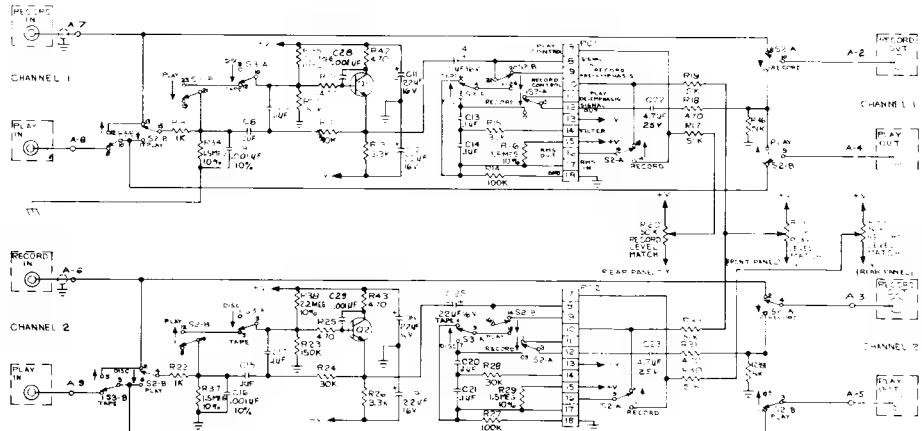
3. We recommend that you insure the package and send it via United Parcel Service wherever possible.

4. Please direct all inquiries to dbx Customer Service Department.

Outside the U.S.A. — contact your nearest dbx dealer for name and address of the nearest authorized repair center.

dbx 122 SCHEMATIC

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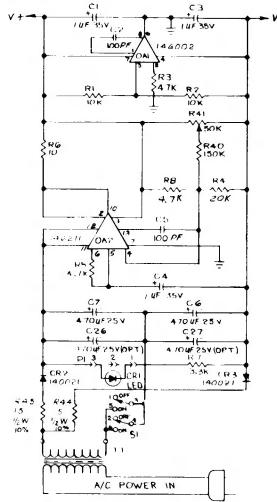
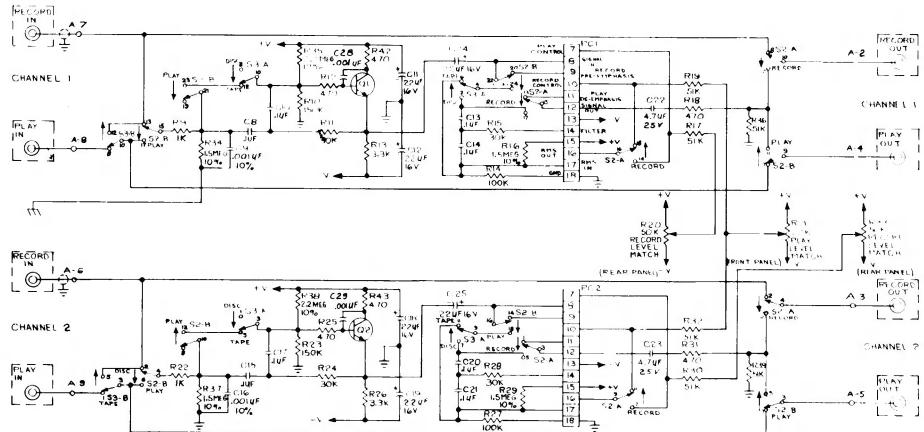
NOTES:
UNLESS OTHERWISE SPECIFIED,
RESISTORS ARE EXPRESSED IN OHMS
THEY ARE 1% & 5%.

2. AST. REFERENCE DESIGNATIONS: Q29
CRS Q2, R45, S3, T1, P1, MC240A2.
3. REFERENCE ASSY DWG # 46-218.

Manufactured under one or more of the following U.S. patents: 3,681,618; 3,714,462; 3,789,143; 4,101,849; 4,097,767. Other patents pending.

dbx 122 SCHEMATIC

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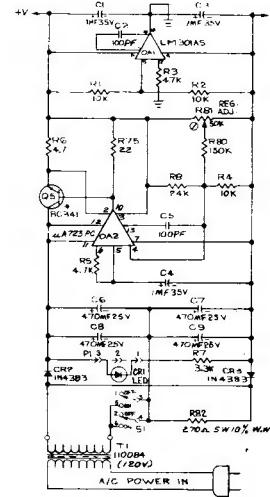
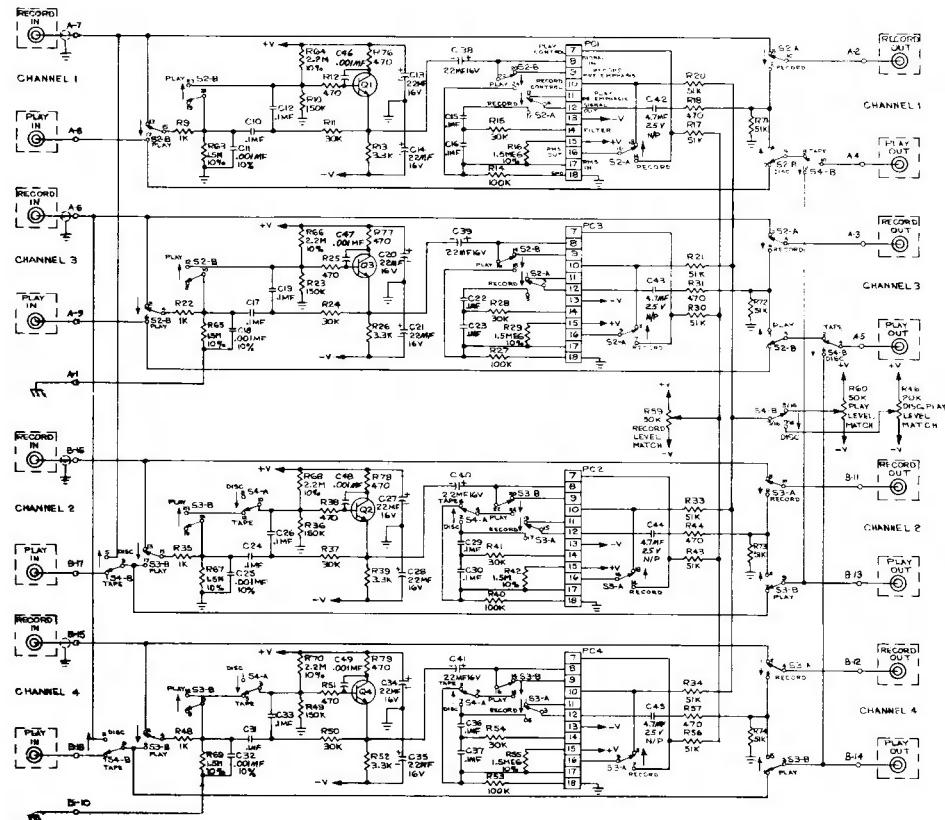
NOTES:
UNLESS OTHERWISE SPECIFIED:
RESISTORS ARE EXPRESSED IN OHMS
AND ARE 1/4W ± 5%.
TRANSISTORS ARE NPN'S AND ARE
N1202E.

2. LAST REFERENCE DESIGNATIONS: G29
CR3, Q2, R45, S3, T1, P1, PC2 (DAZ).
3. REFERENCE ASSY DWG # 260218.

Manufactured under one or more of the following U.S. patents: 3,681,618; 3,714,462; 3,789,143; 4,101,849; 4,097,767. Other patents pending.

dbx 124 SCHEMATIC

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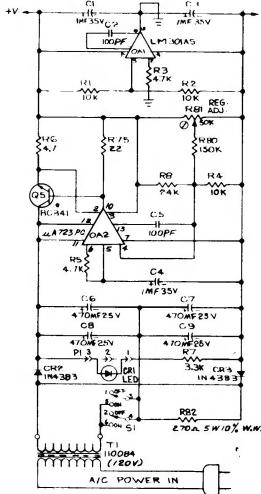
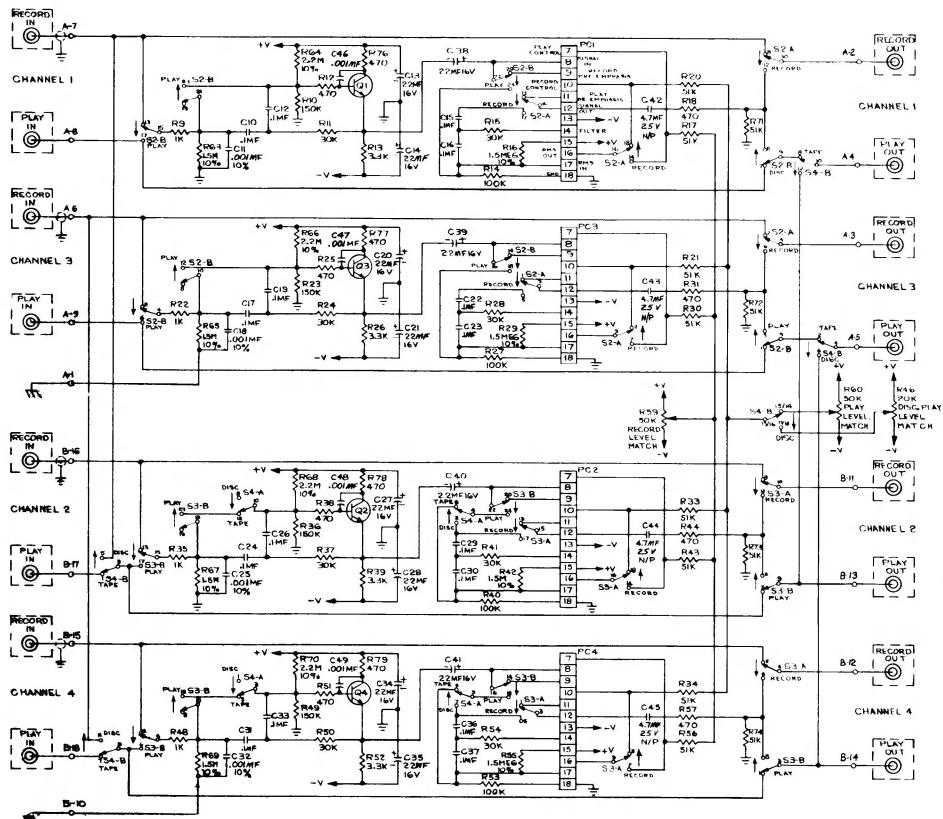
NOTES:

1. UNLESS OTHERWISE SPECIFIED:
RESISTORS ARE EXPRESSED IN OHMS
AND ARE $14W \pm 5\%$.
2. TRANSISTORS ARE NPN's AND ARE BC209C.
* INDICATES HEAT BINK AND TRANSISTOR
ON DEVICE.
3. LAST REFERENCE DESIGNATIONS: C41,
CR3, Q5, R26, S4, TI, PI, PC4, OA2.
4. REFERENCE ASY. DME-26022.

Manufactured under one or more of the following U.S. patents: 3,681,618; 3,714,462; 3,789,143; 4,101,849; 4,097,767. Other patents pending.

dbx 124 SCHEMATIC

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NOTES:

- 1. UNLESS OTHERWISE SPECIFIED:
RESISTORS ARE EXPRESSED IN OHMS
AND ARE $1\text{W} \pm 5\%$.
- 2. TRANSISTORS ARE NPN's AND ARE BC209C's
* INDICATES HEATSINK AND TRANSPIRATED
ON DEVICE.
- 3. LAST REFERENCE DESIGNATIONS: C41,
CR3, Q5, RB254, TI, PI, PCA10A2.
- 4. REFERENCE ASSY: DUC-26022.

Manufactured under one or more of the following U.S. patents: 3,681,618; 3,714,462; 3,789,143; 4,101,849; 4,097,767. Other patents pending.

dbx, Inc.
71 Chapel Street
Newton, MA 02195

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Other patents pending.